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**MANUAL FOR THE USE  
OF THE GLOBES**

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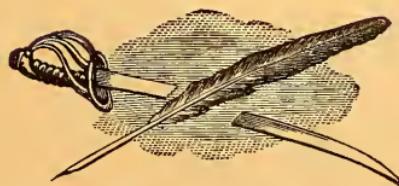


AN ILLUSTRATED  
MANUAL  
FOR THE USE OF THE  
TERRESTRIAL AND CELESTIAL  
GLOBES.

BY

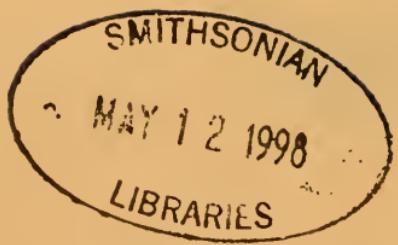
**JOS. SCHEDLER.**

Revised Edition.



NEW YORK:  
**E. Steiger.**

1878.



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## *Introductory.*

It must be quite obvious that the *Globe* is the most effective means of illustrating the general facts of geographical science. For the study of the minute details of small sections of the earth's surface, maps are, of course, more convenient; but it is only after the use of the globe that the latter become really available as helps to the study of geography.

The SCHEDLER Globes present many features that especially commend them to favor. Their scientific merit has never been disputed. They combine extreme lightness and elegance with the greatest possible durability. They form a very attractive ornament to the library, study, or drawing-room. They are very useful in the merchant's office, and indispensable in the school-room. They supply the maximum of information compressible within their space, and yet extreme clearness is every-where observable. They are produced by a patented process at a price which places them within the reach of all.

Formerly, many persons were deterred for various reasons from purchasing Globes, notwithstanding their great and manifold advantages over maps as aids to education. Globes were heavy and cumbersome; they were made of such material as rendered them liable to get out of shape or to be easily broken; and, lastly, they were very expensive. Besides these *material* drawbacks, the amount of information furnished by them was comparatively small.

It required many years to remedy all these defects. But if the verdict of the most critical judges in the world has any weight, we are constrained to believe that these short-comings have been successfully met in the Globes for which this *Manual* is specially written. Paris, Vienna, and Philadelphia have decided the question of their superiority. The Gold Medal was awarded them at the Paris Exposition of 1867, and the Medal of Merit at the Vienna Exhibition of 1873. The Centennial Exhibition at Philadelphia has signally demonstrated their unrivaled excellence, inasmuch as they were the *only* Globes that there obtained an Award.

The *Manual* is designed to afford a complete guide to the use of both the Terrestrial and Celestial Globe; and, while subserving this purpose, will prove a valuable aid in the acquisition of a general knowledge of both geographical and astronomical science.

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## The Use of the Globes.

### *General Explanations.*

#### **The Earth as a Heavenly Body, or Planet.**

In space we see countless bodies, such as the sun, the moon, and the stars, which are called *heavenly bodies*. They are divided into *Stars*, *Planets*, and *Comets*.

The *Stars* (sometimes called *fixed stars*) seem not to change their relative positions, on account of their great distance from us. The light they emit is their own, as they are considered to be bodies like the sun. Hence, they are said to be luminous bodies.

The *Planets* are opaque bodies; they receive their light from the sun, and move in elliptical orbits around him. The earth is a planet.

*Comets* are bodies which revolve around the sun in elongated paths, and usually have a train, called the tail. They appear from time to time, often quite unexpectedly, and soon pass out of sight again.

#### **Form of the Earth.**

The planet inhabited by man is called the *Earth*. Its shape is nearly that of a sphere, being somewhat flattened at two diametrically opposite points, and is therefore called an *oblate spheroid*. The spherical form of the earth is proved by the following facts :

1. If we stand upon a place where we have an uninterrupted view all around, the surface of the earth seems to be bounded by the vault of the sky, which appears to rest upon it. This boundary, which is called the *sensible horizon* (see *Fig. 6*), seems to us to be the circumference of a circle whose surface is formed by the earth's own surface (horizontal or visible surface), and in the center of which we stand.

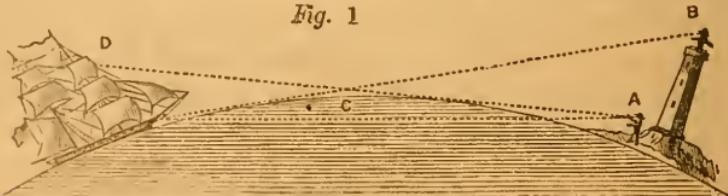
At sea, the view being uninterrupted, this circle in which the earth and sky appear to meet is more clearly seen. It is sometimes called by sailors the *offing*.

2. The sensible horizon expands in proportion to the height of the point of view. The tops of the mountains are the first objects which catch the sun's rays, those to the east receiving them sooner than those to the west.

3. The gradual appearance of approaching, and the disappearance of receding objects. The most convincing proof of the spherical shape of the earth is, that the tops of masts remain longest visible; whereas, if the earth were flat, the hulls of vessels would be seen longest, because of their greater size.

Here (*Fig. 1*) the observer, upon the shore at A, sees only the topmasts of the ship, while the man standing upon the tower B sees the masts and sails, and part of the hull of the ship. Now, if the water between A and the ship D were exactly flat instead of convex, the vision of A would extend along the line C, and he could see the ship as well as B. The advantage of B over A, in consequence of his elevation, shows that the surface of water is convex between A and the ship D.

*Fig. 1*



4. The fact that the earth has actually been sailed round many times.

5. The earlier rising and setting of the stars when we travel eastward, and the contrary fact when we travel westward.

6. The disappearance of the southern stars as we travel northward, and the contrary phenomenon as we advance southward.

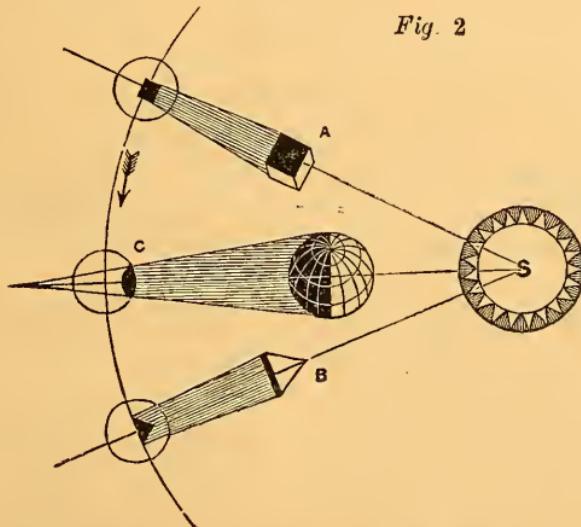
7. The analogy of other heavenly bodies. During eclipses of the moon, the earth's shadow appears on the moon's disk as the segment of a circle. We can see, too, with the naked eye that the sun and moon are round, and the telescope shows the same in the case of the planets, as might be expected from spheres. Analogy, therefore, obliges us to assume that the shape of the earth is the same.

8. Measurements of celestial and terrestrial arcs. The measurement of equal distances at different points of the earth's surface, results in showing arcs of almost exactly the same number of degrees.

**Form of the Earth's Shadow.**

Were the earth a *cube* as shown at A, or in the form of a *prism*, as represented at B, its shadow, as seen upon the moon's disc, would, approximately, exhibit the form of a square or triangle, as seen in the cut; but, instead of this, it is *curvilinear on all sides*, as represented at C, plainly indicating the spherical form of the earth which casts it.

Fig. 2



**Flattening of the Earth at the Poles.**

The measurements made at various places have proved that a meridian-degree is smaller near the equator than in the vicinity of the poles. Hence, it has been concluded that the earth is flattened at the poles, and is consequently not a perfect sphere, but an oblate spheroid. Moreover, a pendulum oscillates more rapidly in the vicinity of the poles than at the equator, which shows that the weight of the pendulum ball must be greater in the former position than in the latter; and this can be caused only by its being at a less distance from the center of the earth at the poles than at the equator.

#### Size of the Earth.

The circumference of the earth is 24,899 miles. An imaginary line drawn from pole to pole through the center of the earth, forming its axis (A A), is 7,899 miles in length. Another line drawn at an equal distance from each pole through the center of the earth would measure 7,925 miles (B B). The former of these lines, by reason of the flattening of the earth's surface at the poles, is shorter than the latter by (7,925 — 7,899) 26 miles.

#### Motion and Position of the Earth.

The earth has a two-fold motion. The one is like that of a wheel upon its axle, and therefore the earth must be looked upon as revolving upon the imaginary line drawn from pole to pole through the center. This is called its rotation upon its axis. The earth revolves upon its axis once in 23 hours 56 minutes and 4 seconds, from west to east. This motion causes day and night, as only one half of the earth can be turned toward the sun at a time. On the half thus turned, it is day; on the other, night. At the equator, the diurnal or daily motion of the earth is at the rate of nearly 1,040 miles an hour.

The other motion of the earth is its course round the sun, which is likewise from west to east. This course the earth completes in its orbit in 365 days, 5 hours, 48 minutes, and 48 seconds; and this period of time is called a year. The earth revolves upon its axis in a direction opposite to the apparent

Fig. 3

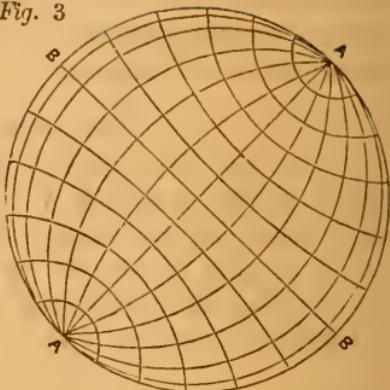
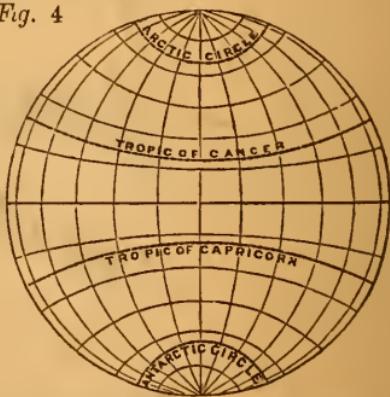


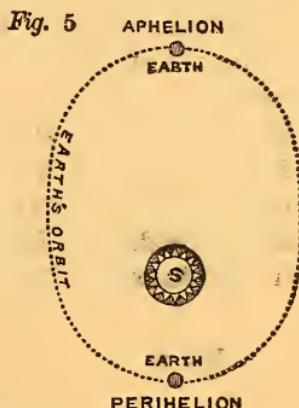
Fig. 4



motion of the heavens. The points of the earth's surface describe circles of gradually decreasing dimensions in proportion as those points approach the poles. The poles are the only fixed, immovable points of the earth's surface. To the observer at the poles, no star ever rises or sets, the heavenly bodies appear to revolve around him in circles. The sun alone rises and sets; but it remains above the horizon one half the year, and below it the other half. An observer so situated has six months' day, and six months' night.

The orbit of the earth round the sun is not a circle. The sun does not stand exactly in the middle of that orbit, but is somewhat nearer to the one side of it than to the other. In winter, the earth is at the point of its orbit nearest the sun (*perihelion*), and its diameter then appears greatest. In summer, the earth is at its greatest distance from the sun (*aphelion*), and its diameter then appears smallest.

It is not, however, the greater or less proximity of the earth to the sun which causes the seasons, but the direction of the sun's rays. When the earth is at the aphelion, the north pole is turned toward the sun, and his rays fall almost perpendicularly upon the northern hemisphere; we then have summer. When the earth is at the perihelion, the south pole is turned toward the sun, and his rays fall obliquely upon the northern hemisphere; we then have winter. The cause of this change is the inclination of the earth's axis to the plane of its orbit; for were the axis upright, the obliquity of the sun's rays at every point of the earth's surface would always be the same. The angle of inclination of the axis is  $23\frac{1}{2}^{\circ}$ . (This can be illustrated very clearly by means of the Tellurian-Globe.)



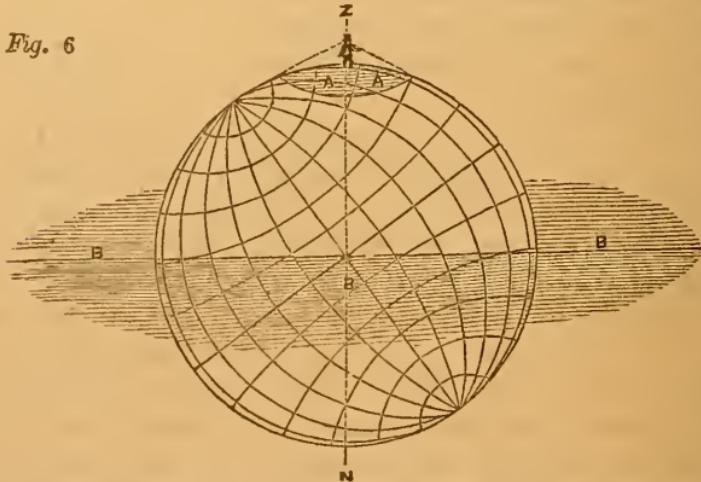
#### North and South Pole. Axis.

Those two points of the earth's surface corresponding to the extremities of the line drawn through the center of the earth,

from one flattened side to the other, are called *poles*; one is called the *north pole*, the other the *south pole*. The line itself is called the *axis*, upon which the earth revolves every 24 hours. (Fig. 3)

#### Horizon.

When we stand on an open plain, or on the deck of a vessel at sea, our view is bounded by a circle, where the sky seems to touch the surface of the earth; this circle is called the *sensible horizon*. The part of the earth's surface which is visible to the eye of the spectator lifted above it, is a small circle (A A), in the center of which he seems to stand. The *rational* or *true horizon* is below the sensible horizon, its plane passing through the center of the earth. As represented in the cut, the sensible horizon, *in the heavens*, is below the rational horizon, owing to the elevation of the eye of the spectator. This is called the *dip of the horizon*. The point immediately above the spectator is called the *zenith*; the opposite point, the *nadir*.



AA Sensible or apparent horizon. BB Rational or true horizon.  
Z Zenith. N Nadir.

#### Points of the Compass.

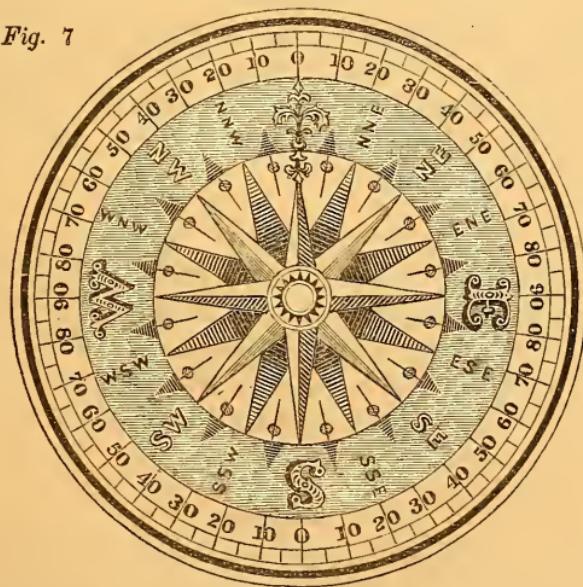
The four chief or cardinal points of the horizon are called East, West, South, North. *East* is exactly that point of the heavens where, in autumn and spring, the sun comes above the

horizon in the morning. *West* is that point where it sets in the evening. These points are exactly opposite to each other. *South* is in the direction of the sun at noon; and *north* directly opposite the south. If we face the point where the sun rises, we shall have the *south* on our *right* hand and the *north* on our *left*.

Between these four cardinal points, there are four intermediate points; namely, between east and south lies *south-east* (S. E.), between south and west lies *south-west* (S. W.), between west and north lies *north-west* (N. W.), between north and east lies *north-east* (N. E.). Next to these intermediate points on either side, lie the secondary points, *e. g.*, *east-south-east* and *south-south-east*, etc., etc.

The *Mariner's Compass* consists of a card on which is drawn a star with 32 rays so as to represent the cardinal and intermediate points of the horizon, and a magnetic needle freely moving on a pivot at the center. This needle, by pointing always toward the north (with slight deflections), enables the mariner to steer his vessel in the right direction.

Fig. 7



#### *Explanation of Terms relating to the Terrestrial Globe.*

The Terrestrial Globe is an artificial representation of the earth. On this globe are represented the divisions of the

earth's surface, the different countries, the chief cities, seas, rivers, etc., according to their relative situations on the real globe of the earth. The artificial globe is a perfectly round body, composed of metal, plaster, or pasteboard.

The terrestrial globe consists of a ball, through the center of which runs an iron axis, whose two ends project, and are fastened to a metal ring, within which it can be turned round.

#### Axis.

The wire which passes from pole to pole through the center of the artificial globe, represents the *axis* of the earth, upon which it is conceived to turn, once every 24 hours.

#### Poles.

The *poles* of the earth are at the two extremities of the wire, where it cuts the surface of the globe. The poles of the earth are only imaginary points.

#### Meridian.

The metal ring, or the circle in which the artificial globe turns, is called the *Brass Meridian*: it is divided into 360 equal parts, called *degrees*. These degrees are numbered from 0 to 90, from the equator towards the poles, and are used for finding the latitude of places.

#### Equator.

Equidistant from the poles is a great circle of the earth, called the *Equator*, which divides the globe into two *hemispheres*, the *Northern* and the *Southern*. The latitudes of places are reckoned from the equator northward and southward, and the longitudes of places are reckoned upon it eastward and westward.

#### Meridians.

*Meridians*, or lines of longitude, are semicircles extending from the north pole to the south pole, and cutting the equator at right angles. Every place upon the globe is supposed to have a meridian passing through it, though there are only 36, or even less, drawn upon the terrestrial globe itself; the de-

ficiency can be supplied by the metal meridian. When the sun reaches the meridian of any place (not within either of the polar circles), it is noon or midday at that place.

The *First Meridian* is that from which geographers begin to reckon the longitudes of places. These are generally reckoned from the semicircle supposed to pass through the Royal Observatory, at Greenwich, England. Different nations reckon longitude from their respective observatories.

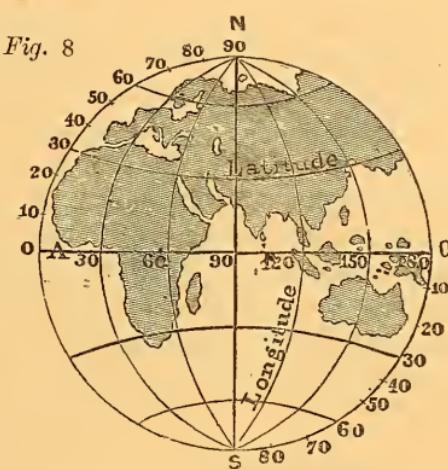
#### Longitude.

The distance of any given place from the first meridian is called its *Longitude*. It is distinguished into east longitude and west longitude, according as a place is east or west of the meridian of Greenwich. The degree of longitude in part determines the position of any place on the earth's surface. The greatest longitude possible is  $180^{\circ}$ , which represents half the distance round the earth, or the greatest distance from the first meridian; and this point is exactly opposite the first meridian on the other side of the earth; from this point forward we are continually approaching the first meridian.

#### Latitude.

(Fig. 8)

It is clear, however, that the longitude alone of any stated place does not determine its *exact* position on the globe; for, if we state the longitude of a place to be  $30^{\circ}$ , it may, nevertheless, be on any point of the half-circle. This point must consequently be more clearly determined; hence the first meridian on both sides of the equator has been divided, from the equator to each pole, into 90 equal parts, which are called



*Degrees of Latitude*; and from each degree circles have been drawn parallel to the equator, which are called *Parallels of Latitude*, and which, as a matter of course, are smaller in proportion as they approach the poles.

By the *Latitude* of a place, therefore, is meant its distance from the equator toward either of the poles. Latitude is distinguished into *North Latitude* and *South Latitude*, according as a place lies north or south of the equator.

#### Tropics.

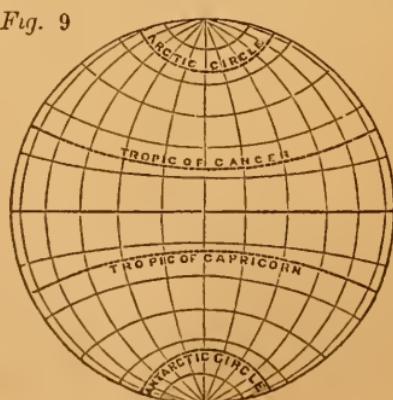
To the parallel circles also belong the two *Tropics*, which are nearly  $23\frac{1}{2}^{\circ}$  from the equator. That on the northern hemisphere is called the *Tropic of Cancer*; that on the southern hemisphere, the *Tropic of Capricorn*.

On the 21st of March, the sun reaches the equator, and then continuously recedes from it northward until he reaches the Tropic of Cancer; here he turns on the 21st of June, and again moves toward the equator; crosses it on the 23d of September toward the south, and declines as far as the Tropic of Capricorn, which he reaches on the 21st of December, and then returns toward the equator.

#### The Polar Circles.

The *Polar Circles* are two small circles parallel to the equator, at the distance of  $66^{\circ} 32'$  from it, or  $23^{\circ} 28'$  from each pole. The northern is called the *Arctic Circle*, the southern the *Antarctic Circle*.

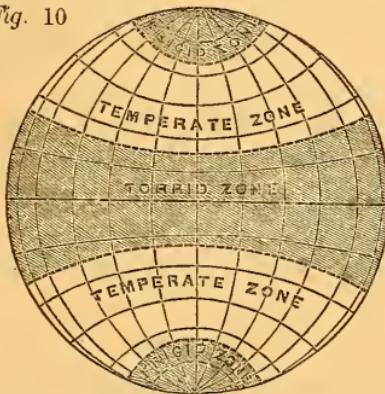
Fig. 9



### The Zones.

By the tropics and polar circles the whole surface of the earth is divided into five girdles, called *Zones*. The zone bounded by the tropic circles is called the *Torrid Zone*, and its inhabitants are called the *Asci* (shadow-less) and *Amphiscii* (double-shadowed), because at midday they either cast no shadow, or when they do, they cast it at one period northward, at another southward, according as the sun is north or south of the equator.

Fig. 10



The two zones contained between the tropic and polar circles are called the *Temperate Zones*, the inhabitants of which are called *Heteroscii* (other-shadowed), because at midday they cast their shadows in different directions, *i. e.* those in the north temperate zone always toward the north pole, those in the south temperate zone always toward the south pole. Lastly, the zones lying around the poles are called the *Frigid Zones*, and their inhabitants are called *Periscii* (circle-shadowed), because, during the period in which the sun is visible to them, they cast their shadows successively toward every point of the compass.

Besides the equator, the parallels, the tropics and polar circles, there is drawn on the globe another great circle called the *Ecliptic*.

### The Ecliptic.

The ecliptic represents the *Fig. 11* position of the sun's apparent orbit in relation to the equator; it is, in fact, the circle in which the plane of the earth's orbit intersects the surface of the earth. It crosses the equator at an angle of  $23\frac{1}{2}^{\circ}$ , called the *Obliquity of the Ecliptic*. Its name *ecliptic* is due to the fact that eclipses can take place only when the moon is at or near its plane. The plane of the equator extended out cuts the sphere of the heavens in a circle called the *Equinoctial*. The sun makes his apparent annual progress in the ecliptic at the rate of nearly a degree a day; since this apparent motion is caused by the annual revolution of the earth around the sun, which is completed in a year, or  $365\frac{1}{4}$  days.



### The Zodiac.

The *Zodiac* is a zone or belt extending  $8^{\circ}$  on each side of the ecliptic, and is divided into 12 equal parts called the *Signs of the Zodiac*, each of which comprises 30 degrees, and is named after one of the 12 groups of stars, or constellations, that are situated near the ecliptic.

Their names, and the signs by which they are known, are as follows:

#### Spring.

$\gamma$  Aries (the Ram),  
21st of March.

$\delta$  Taurus (the Bull),  
19th of April.

$\text{II}$  Gemini (the Twins),  
20th of May.

#### Summer.

$\varpi$  Cancer (the Crab),  
21st of June.

$\Omega$  Leo (the Lion),  
22d of July.

$\text{m}$  Virgo (the Virgin),  
22d of August.

#### Autumn.

$\text{L}$  Libra (the Balance),  
23d of Sept.

$m$  Scorpio (the Scorpion),  
23d of Oct.

$\text{f}$  Sagittarius (the Archer),  
22d of Nov.

#### Winter.

$\wp$  Capricornus (the Goat),  
21st of Dec.

$\text{w}$  Aquarius (the Water-  
bearer), 20th of Jan.

$\text{x}$  Pisces (the Fishes),  
19th of Feb.

**Antœci, Perioeci, Antipodes.**

Those who live on the same meridian, but on different sides of the equator, on opposite parallels of the same degree reckoned from the equator, are called *Antœci*. Their seasons are the reverse of each other, but their time of the day is the same. Those who live on the equator have no Antœci.

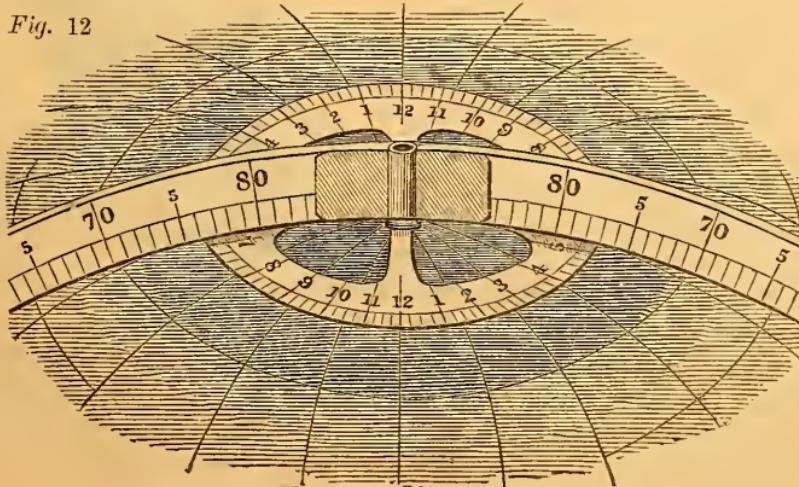
Our *Perioeci* are those who live upon the same parallel of latitude as ourselves, but at a distance of  $180^{\circ}$  from us on the opposite side of the globe. Their seasons are simultaneous with ours, but their times of the day and night are the reverse of ours; so that when it is midday with us, it is midnight with our perioeci, and *vice versa*.

Our *Antipodes* are those who live in the southern hemisphere under the same degree of latitude and on the opposite meridian of longitude, so that they stand with their feet opposite to ours, at the other extremity of a line drawn through the center of the earth. Their seasons and times of the day and night are opposite to ours.

**The Hour-Circle.**

The *Hour-Circle* (Fig. 12) on the artificial globe is a small brass circle below the metal meridian, which latter answers for an index. The hour-circle is divided into 24 equal parts, corresponding to the hours of the day, and these are again subdivided into halves and quarters.

Fig. 12



Just as the midday-circle, or meridian, shows the difference of degrees between places according to their position, so the hour-circle at the north pole shows the difference between all places according to time, in hours; and this in such a manner that the eastern half shows the hours before noon (*Ante Meridiem, A. M.*), and the western half the hours after noon (*Post Meridiem, P. M.*).

The hour-circle is fixed to the axis, but in such a manner that it can be moved without communicating any motion to the globe, and any given number upon it can be brought under the meridian. If one complete revolution of the globe is made, and the 360 degrees of the equator have passed under the meridian, the hour-circle also describes the complete circle of 24 hours, consequently for every hour that passes the meridian the globe must have traveled 15 degrees.

**NOTE.** The proper use of the hour-circle will be more fully explained in the solution of the problems.

#### The Artificial Horizon.

The broad horizontal ring which surrounds the artificial globe, having two slots in which the meridian, and with it the globe, moves, is called the *Artificial Horizon* (Fig. 13, A A). This represents the position of the rational or true horizon.

This horizon is divided into several concentric circles.

The *first circle* is marked *Amplitude*, and is numbered from the east toward the north and south, from 0 to 90 degrees, and from the west toward the north and south in the same manner.

The *second circle* is marked *Azimuth*, and is numbered from the north point of the horizon toward the east and west from 0 to 90 degrees; and from the south point of the horizon toward the east and west in the same manner.

Fig. 13



The *third circle* contains the thirty-two points of the compass, divided into half and quarter points. The degrees in each point are to be found in the *Azimuth* circle.

The *fourth circle* contains the twelve signs of the zodiac, with the figure and character of each sign.

The *fifth circle* contains the degrees of the signs, each sign comprehending 30 degrees.

The *sixth circle* contains the days of the months, answering to each degree of the sun's place on the ecliptic.

The *seventh circle* contains the *equation of time*, or difference of time shown by a well-regulated clock and a correct sun-dial. When the clock or watch ought to be faster than the dial, the number of minutes expressing the difference has the sign + before it; when the clock ought to be slower, the number of minutes expressing the difference has the sign — before it.

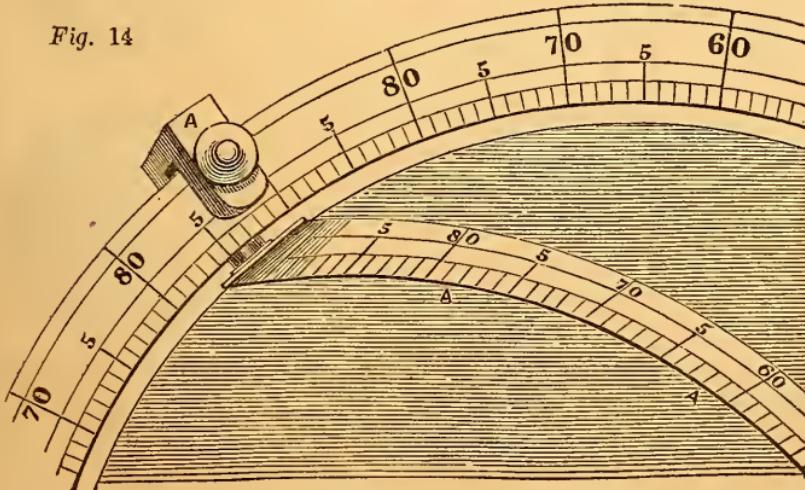
The *eighth circle* contains the twelve calendar months of the year.

The cardinal points of the horizon are east, west, north, and south.

NOTE.—The equation of time arises from the obliquity of the ecliptic, and the eccentricity of the earth's orbit.

#### The Quadrant.

Fig. 14



The *Quadrant of Altitude* is a thin slip of brass divided upward from 0 to 90 degrees, and downward from 0 to 18 degrees, and is generally screwed to the *Meridian* (A). This can be used for measuring angular distances in any direction on the sphere. The upper divisions are used so as to determine the distances of places on the earth; and the lower divisions are applied to finding the beginning, end, and duration of twilight.

**Positions of the Sphere.**

There are three *Positions of the Sphere*, as shown by the manner in which the globe is placed in respect to the horizon:

1. The *right sphere*, when we lay both poles in the horizon. This position serves to show the astronomical position of those who dwell at the equator.

2. The *parallel sphere*, when the poles are  $90^{\circ}$  distant from the horizon, *i. e.*, are perpendicularly over each other. This position is used as often as we have to do with phenomena which take place at the poles.

3. Lastly, the *oblique sphere*, when the axis of the earth inclines obliquely to the horizon. This inclination varies with the geographical latitude of the place of observation. This is the position of the globe almost exclusively used, as will be seen from the majority of the problems for solution.

To use the globe in this position we must know, at least approximately, the latitude of our stand-point.

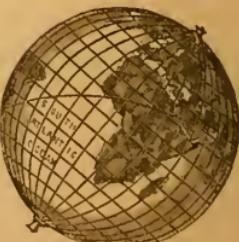
Fig. 15



Fig. 16



Fig. 17



***Problems solved by the Terrestrial Globe.***

**Placing and Setting the Globe.**

**PROBLEM I.** 1. To set a globe means to bring its stand, its meridian, and the globe itself into such positions that they may represent the real position of the earth in relation to the horizon of any place on its surface.

For this purpose the table, or at least the globe-stand, should be placed horizontally.

2. The north point marked on the horizon must point north; the south point, south.

3. When the globe has been properly set, the brass meridian is drawn round, and the north pole is raised (or the south pole, if the stand-point is in the southern hemisphere) as many degrees above the horizon as correspond to the latitude of the place (counting the requisite number of degrees from the north pole); the globe is then turned round, and the place brought under the meridian. In this way it stands in the *Zenith*, *i. e.*, the highest point of the hemisphere above the horizon; and the artificial horizon, which encircles the globe, then forms the *true* horizon of the place.

**PROBLEM II.** *A place being given, to find its geographical position, or its Latitude and Longitude.*

**RULE.** Turn the globe round until the place mentioned stands exactly under the graduated edge of the brass meridian, and the degree of the meridian over the place will be its latitude; and the degree on the equator where the meridian crosses it will be the longitude.

**PROBLEM III.** *To find the difference of Longitude or Latitude between two places:*

*a) of Longitude.*

**RULE.** Bring both the places, one after the other, under the meridian, and mark what point of the equator the meridian intersects in each of the two places. Subtract the less from the greater number, and the result will be the difference in degrees.

*b) of Latitude.*

RULE. Bring the place under the meridian, and find its latitude (PROB. II); then bring the other place likewise under the meridian, and find its latitude. The less subtracted from the greater will give the difference required.

**PROBLEM IV.** *To find the distance between different places.*

RULE. Bring one of the two places under the meridian, and fasten the quadrant of altitude exactly over the given place, the quadrant being brought to the other place will show the difference in degrees; reduce this number of degrees to miles. A degree contains 60 geographical or nautical miles, or 69.16 statute miles. Multiply the number of the given degree by 60, and you have the number of geographical or nautical miles; by 69.16, and you have the number of statute miles.

**PROBLEM V.** *To find the difference of time at different places.*

RULE. Bring to the meridian the place which lies west of the other, and set the hour-circle at 12. Turn the globe westward, until the other place comes to the meridian, the hour-circle will show the hour at the second place, when it is noon at the first. The hour thus found is the difference required.

**PROBLEM VI.** *The hour being given at any place, to find what hour it is at any other place.*

RULE. Find the difference of time between the two places (PROB. V); then, if the place whose time is required, be east of the other, add this difference to the given time; if west, subtract it.

**PROBLEM VII.** *To find the places at which midday and midnight occur at the same time as at any given place.*

RULE. The solution follows from the explanation of the meridian. If the given place be brought under the meridian, all the places which lie under the same meridian, have midday at one time; the places on the other side of the meridian have midnight.

PROBLEM VIII. *At a given place, and at a stated hour, to find the places which at that hour have midday or midnight.*

RULE. After the given place has been brought under the meridian, place the hour-circle on the given hour,—if the hour be in the forenoon, on the east, and if in the afternoon on the west hour-number; and turn the globe until the hour-circle stands over 12 o'clock : then all the places at which it is midday at the hour given, will be under the upper semicircle of the meridian. If the globe be now turned to 12 o'clock at night, under the upper semicircle of the meridian will be found all the places which have midnight at that hour.

PROBLEM IX. *To find in what sign of the Zodiac, and at what degree of the Ecliptic, the Sun stands on a given day.*

RULE. Find the given day of the month in the month-circle of the horizon. Corresponding to this day, on the inner circle, stands the sign of the zodiac, and the degree of the ecliptic at which the sun is in his apparent orbit.

PROBLEM X. *To find the Antæci, Periæci, and Antipodes of the inhabitants of any place.*

RULE. *For the Antæci.* Bring the given place to the meridian, and observe its latitude; then, in the opposite hemisphere under the same degree of latitude, you will find the *Antæci*.

*For the Periæci.* Bring the given place to the meridian, and set the hour-circle at 12 ; turn the globe half round, or till the hour-circle points to the other 12 ; then, under the latitude of the given place, you will find the *Periæci*.

*For the Antipodes.* Bring the given place to the meridian and set the hour-circle at 12 ; turn the globe half round, or till the hour-circle shows the other 12 ; then, under the same degree of latitude with the given place, but in the opposite hemisphere, you will find the *Antipodes*.

PROBLEM XI. *A place being given on the globe, to find all places which are situated at the same distance from it as any other given place.*

RULE. Lay the graduated edge of the quadrant over the two places, so that the division marked 0 may be at one of the

places; then observe what degree of the quadrant stands on the other place; move the quadrant entirely round, keeping the division marked 0 in its first situation, and all places passing under the same degree, which was observed to stand over the other place, will be those sought.

Or, place one foot of a pair of compasses at one of the given places, the other foot at the other given place, and let the former foot be the center with this radius, the latter foot will pass through all the places sought.

PROBLEM XII. *The position of the sun being given, to find the day.*

RULE. Let the position of the sun be, for example, in the twentieth degree of *Gemini*; on what day of the year does the sun stand at this point? — Find the given sign of the zodiac, with the degree, on the horizon: *Gemini* stands between the months of May and June, the twentieth degree stands at the 6th of June, which is the day sought.

PROBLEM XIII. *To find the Sun's Longitude (commonly called the sun's place in the ecliptic) and his declination.*

RULE. Look for the given day in the circles of months on the horizon, against which, in the circle of signs, are the sign and degree at which the sun is on that day. Find the same sign and degree on the ecliptic on the surface of the globe; bring the degree of the ecliptic, thus found, to that part of the meridian which is numbered from the equator toward the poles; its distance from the equator, reckoned on the meridian, is the sun's declination.

PROBLEM XIV. *The month and day of the month being given, to find all places on the earth where the Sun is vertical on that day; those places where the Sun does not set, and those places where he does not rise on the given day.*

RULE. 1. Find the sun's declination (PROB. XIII) for the given day and mark it on the meridian; turn the globe round on its axis from west to east, and all the places, which pass under this mark, will have the sun vertical on that day.

2. Elevate the north or south pole, according as the sun's declination is north or south, as many degrees above the horizon as are equal to the sun's declination; turn the globe on its axis from west to east; then to those places which do not descend below the horizon, in the frigid zone near the elevated pole, the sun does not set on the given day; and to those places which do not ascend above the horizon, in the frigid zone adjoining the depressed pole, the sun does not rise on the given day.

**PROBLEM XV.** *To find the sun's meridian altitude at any given place, on any day of the year.*

**RULE.** Elevate the north or south pole, according as the place is north or south of the equator, a number of degrees equal to the latitude of the place; the artificial horizon will then represent the horizon of the place. Then find the sun's place in the ecliptic, and bring it to the graduated edge of the brass meridian; and the number of degrees on the meridian between the sun's place and the horizon will be the meridian altitude.

**PROBLEM XVI.** *To find the sun's altitude at any given place, on any day of the year, and at any hour of the day.*

**RULE.** Elevate the north or south pole, according as the place is north or south of the equator, a number of degrees equal to the latitude of the place; find the sun's place in the ecliptic, bring it to the meridian, and set the hour-circle at 12 noon; then turn the globe till the hour-circle stands at the given hour, and place the quadrant so that it may pass through the zenith and the sun's place, and the number of degrees between the latter and the horizon will be the altitude required.

**PROBLEM XVII.** *To find the time of sunrise and sunset, and the length of the day, at any place, on any day of the year.*

**RULE.** Elevate the pole (PROB. XV), find the sun's place in the ecliptic, bring it to the meridian, and set the hour-circle at 12. Then turn the globe till the sun's place is brought to the eastern edge of the horizon, and the hour-circle will show the time of sunrise; bring it to the western edge of the horizon, and the hour-circle will show the time of sunset.

Twice the time of sunset will be the length of the day; and twice that of sunrise will be the length of the night.

PROBLEM XVIII. *To find the length of the longest day and of the shortest day at any place not in either of the frigid zones.*

RULE. If the place be in the northern hemisphere, find the length of the day when the sun is at the northern solstice (June 21.), and this will be the longest day; then find the length of the day when the sun is at the southern solstice (Dec. 21.), and this will be the shortest day. Reverse these directions for the southern hemisphere.

PROBLEM XIX. *To find the beginning, end, and duration of constant day and constant night at any place situated within either of the polar circles.*

RULE. Subtract the latitude of the place from  $90^{\circ}$ , and it will give the polar distance. On the meridian, find the same number of degrees, from the equator; and on turning the globe round, note what two points of the ecliptic pass under that degree of the meridian, and these will be respectively the places of the sun at the time of the commencement and end of constant day at the given place. Find the day of the month corresponding to each; and the difference of time between these two days will be the duration of constant day. Work the problem for a place situated in the same degree of latitude in the other polar circle, and the beginning, end, and duration of constant night for the former will be found; since constant day in one polar circle corresponds to constant night in the other.

PROBLEM XX. *To find the beginning, end, and duration of twilight at any given place, and on any day of the year.*

RULE. Bring the sun's place to the western edge of the horizon (PROB. XVII), the hour-circle having been placed so as to show the time of sunset; and screw the quadrant at the zenith, letting it pass through the sun's place. Then turn the globe till the sun's place is  $18^{\circ}$  below the horizon as shown by the quadrant and the hour-circle will indicate the time at which evening twilight ends at the given place. The interval between this and sunset will be the duration.

**PROBLEM XXI.** *The month, day, and hour of the day at any place given, to find all those places of the earth, where the sun is rising, those places where the sun is setting, those places that have noon, that particular place, where the sun is vertical, those places that have morning twilight, those places that have evening twilight, and those places that have midnight.*

**RULE.** Find the sun's declination (PROB. XIII) and mark it on the meridian; elevate the north or south pole, according as the sun's declination is north or south, as many degrees above the horizon as are equal to the sun's declination; bring the given place to the meridian, and set the hour circle to 12; then if the given time be *before* noon, turn the globe *westward* as many hours as it wants of noon; but if the given time be *past* noon, turn the globe *eastward* as many hours as the time is past noon; keep the globe in this position; then all places along the western edge of the horizon have the sun rising; those places along the eastern edge have the sun setting, those under the meridian, above the horizon, have noon; that particular place which stands under the sun's declination on the meridian, has the sun vertical; all places below the western edge of the horizon, within  $18^{\circ}$ , have morning twilight; those places which are below the eastern edge of the horizon, within  $18^{\circ}$ , have evening twilight; all places under the meridian below the horizon have midnight; all places above the horizon have day, and those below it have night or twilight.

#### The International Date-Line.

We have previously seen that day and night are caused by the rotation of the earth upon its axis. All places situated under the same meridian, and which, consequently, have the same geographical longitude, have at the same moment mid-day or midnight, in other words, have the same time.

On the other hand, if one starts from any given meridian, on any one of the imaginary circles drawn upon the globe parallel to the equator (parallels of latitude), either eastward or westward, the clock at a place lying eastward will be seen to indicate a later time than at a place lying to the west. The

reason of this is, that, on account of the motion of the earth from west to east, the sun rises earlier at the place lying eastward than at that to the west. The difference of time thus produced is 4 minutes for each degree.

This accounts for the experience, centuries ago, of the first circumnavigators, that a ship which sails round the earth from east to west, that is, in the same direction as the apparent motion of the sun, seems to have lost a whole day upon arriving at her point of departure. On the contrary, if the voyage has been made from west to east — that is, in a direction opposite to the apparent motion of the sun — the ship will appear to gain a day in her reckoning.

This creates a difference not only in the hour of the day, but also in the day of the week and the day of the month. This difference, moreover, occurs not only on occasion of a voyage round the world, but even between two places, one of which is far enough eastward or westward of the other, that is, between whose geographical longitudes the difference is sufficiently great. For example, when Monday, Jan. 15th, dawned in Leipsic, it was still 11.20 P. M. on Sunday, Jan. 14th, in Paris; and in New York, it was 6.15 P. M. on Sunday.

As each parallel of latitude is divided into 360 degrees, the total of which corresponds to 24 hours, it is clear that, by starting from any given point of the hemisphere, and traveling 180 degrees either eastward or westward, a point will be reached diametrically opposite the starting-point. For such a point, consequently, from what has been said above, there must be two different reckonings of time varying by 24 hours.

According as the journey was made eastward or westward, this point would have two different dates and two different days of the week. But, as any given point on the earth can have only *one* absolute time, it follows that there must be on each parallel of latitude a point where the date, so to speak, makes a leap of 24 hours; and to two persons at places lying on either side of this point of variation, even although their absolute time differed but slightly, there would be, according to their respective reckonings, a difference of time amounting to a whole day.

Theoretically, this point might be placed anywhere on the earth; but for the sake of uniformity, the navigators of European nations, meeting in the great Pacific ocean opposite to Europe, have determined that *there* this date-line should run. The accompanying map shows its course.



As will be seen, this date-line starts from the south pole, strikes almost directly north; then inclines, east of New Zealand, gradually more to the north-west, and runs thus on the east side of Australia by the New Hebrides and New Guinea as far as the China Sea. Here, after attaining its greatest western projection, it makes a sweep to the east and north, and, leaving the islands of Celebes and Borneo to the southwest, passes round the easterly lying Philippines, and moves onward in a north-eastward direction to the east side of the Japanese islands, and past these into Behring's Strait, from which, skirting the coast of the continent of Asia, and again taking a northerly bend, it ends at the north pole.

If to the east of this line it is Sunday, on the 1st day of a given month; then, at all points west of it, it is Monday, the 2d of the month. As shown by the map, this line lies almost wholly in the sea. If now a vessel circumnavigating the globe wishes to agree in her reckoning of time with that of her port of departure, it is necessary, if the voyage be eastward, to drop a day on the way, but if westward, to count a day twice over. This should, of right, be done on passing the date-line. It is, however, usual among navigators, to make this rectification on crossing the 180th meridian from Greenwich, tolerably near which, as will be seen from the map, the extreme northern and southern projections of the date-curve come.

Finally, it may be remarked that, as our date-line is identical with no one meridian, there must be a point, at its extreme eastern projection, which first receives the sun's rays, and where, consequently, the New Year begins. This point might be called the New Year's point. The place which corresponds to this point, is Chatham Island, east of New Zealand (about 183 degrees east of the meridian of Greenwich, and in the 44th degree of south latitude). In this regard the Chatham Islanders are in advance of all the rest of the world.

Thus we have become acquainted, in this remarkable line, with an *International Date-line* founded upon the mathematico-geographical relations of the various portions of the earth, which line hitherto, to some otherwise well-informed persons, has been an enigma.

### *Astronomy.*

The region in which the greatest and most splendid phenomena meet our eyes, is called *Space*, or the *Heavens*; and those masses which are to be seen in it, are called *Heavenly Bodies*, or, more usually, *Stars*. The space in which they move is infinite; and their number, countless. A knowledge of the vast distances of these bodies, as well as of the inconceivable velocity of their motions, lends to these phenomena a peculiar magnificence and solemnity. The science which instructs us in regard to these phenomena, partly disclosing the secrets of the heavens, is called *Astronomy*.

Astronomy is coeval with the history of man ; for the same heavens which are above us to-day rejoiced the eye of man with their sparkling army of stars, and aroused his attention thousands of years ago. Yes, we may say that the uneducated son of the desert, and the nomad of the great plains, bestow more attention upon the heavens and their phenomena than the population of our cities. For to the former, the stars are at once a clock, a sign-post, a compass, a barometer, and an almanac; whilst, from the narrow streets of the cities, it is but seldom that the eye is turned toward that strip of the firmament which is open to the spectator.

### *Description of the Heavenly Bodies.*

If we contemplate the firmament of stars at night, they seem to be all at an equal distance from us. Consequently we stand, as it were, within a hollow sphere, of which we can only see the half. The stars change but very slightly their relative positions to each other, but they all constantly change their positions in relation to the spectator, some disappearing below the horizon, others appearing above it, as the sphere seems to move round the earth.

Those bodies which seem scarcely to move in the apparent celestial sphere, but remain almost fixed in their relative positions, are called *Stars*. They are also distinguished from the other bodies by the fact that they have no borrowed light, but sparkle with their own radiance.

*Planets* are those celestial bodies which are seen constantly to change their positions among the stars. Hence their name *planets* — wandering bodies. They revolve round the sun in orbits almost circular and but slightly inclined to each other, and receive their light and heat from that luminary.

These are divided into *Principal Planets* and *Planetoids*. The names of the former in the order of their distance from the sun are: *Mercury*, *Venus*, the *Earth* (with 1 moon), *Mars* (with 2 moons), *Jupiter* (with 4 moons), *Saturn* (with 8 moons), *Uranus* (with 4 moons), *Neptune* (with 1 moon).

*Planetoids*, or *Asteroids*, are the multitude of small planets which revolve round the sun between the orbits of *Mars* and *Jupiter*.

Besides the above mentioned planets, with their moons or satellites, there is a countless multitude of other heavenly bodies, which likewise change their positions among the stars, whilst they revolve round the sun as their center; they are called *Comets*. No comet is constantly visible in the heavens, as these bodies generally appear unexpectedly, and increase in brilliancy and apparent size as they approach the sun. After the comet has attained its greatest brightness, it gradually decreases, and at last disappears again in space.

#### Clusters of Stars, Double Stars, Nebulae.

In certain parts of the heavens, there are compact groups of stars, called *Clusters*. The *Milky Way*, which crosses the heavens almost in the form of a great circle of unequal width, has been resolved by powerful telescopes into separate very small and very compactly grouped stars.

*Double Stars* are those which appear single to the naked eye, but are shown to be double under the telescope. Some of them are only optically double (although really far apart, being in the same line of view); others are actually so, revolving either round a common center, or one round the other. These are called *binary stars* or *binary systems*.

*Nebulae* are cloudy, or faintly luminous, spots of various forms; they are mostly visible only to the telescope, and not unfrequently have within them a bright, luminous nucleus.

Some, by means of the most powerful telescopes, have been detected to be clusters of single stars, similar to the *Milky Way*. The number of nebulae is very great; we know at present about 4,000 of them, many of which any good telescope will show on a clear night when the moon is not visible.

Those stars which show a periodical or irregular change of color or brilliancy, are called *variable stars*. At the very first view of the sky, we notice a great difference between the stars with which it is spangled. Some are so bright, and look so clear to us, that we can see them immediately after sunset; while others, being weaker or smaller, are only visible later, when the night is more advanced; and still others cannot, even under the most favorable circumstances, be seen without the use of a telescope.

#### Magnitude of the Stars.

The stars, with respect to their apparent splendor, are divided into different classes, called *magnitudes*. The brightest are called stars of the first magnitude; the next in splendor, stars of the second magnitude; and so on to those which are just perceptible to the naked eye, and which are called stars of the sixth magnitude. Those stars, which cannot be discerned without the aid of a telescope, are called *Telescopic Stars*, and are divided into similar classes according to their magnitudes.

#### Constellations.

For the purpose of conveniently locating and classifying the stars, they have, from the earliest antiquity, been arranged, on the globe and in maps, in groups called *constellations*, each having a particular form and designation. These designations have had in view sets of stars; but the groups of stars of which we are treating do not, for the most part, represent the forms of the constellations.

According to their position in the northern or the southern hemisphere, the constellations are divided into northern, southern, and those of the zodiac. The best known by name are the twelve constellations of the zodiac: 1. Aries, *the Ram*

(Widder); 2. Taurus, *the Bull* (Stier); 3. Gemini, *the Twins* (Zwillinge); 4. Cancer, *the Crab* (Krebs); 5. Leo, *the Lion* (Löwe); 6. Virgo, *the Virgin* (Jungfrau); 7. Libra, *the Balance* (Waage); 8. Scorpio, *the Scorpion* (Skorpion); 9. Sagittarius, *the Archer* (Schütze); 10. Capricornus, *the Capricorn, or Goat* (Steinbock); 11. Aquarius, *the Water-bearer* (Wasserträger); 12. Pisces, *the Fishes* (Fische).

The individual stars of each constellation are distinguished from each other by Greek or Latin letters, and also by numbers; only a few of the stars have special names. The order of letters generally follows the degree of radiance, or the so-called apparent size of the stars; *i. e.*, the brightest star of a constellation usually takes the first letter of the Greek alphabet  $\alpha$ , Alpha; and after it come the stars  $\beta$ , Beta,  $\gamma$ , Gamma,  $\delta$ , Delta, etc.

#### Study of the Heavens by Night.

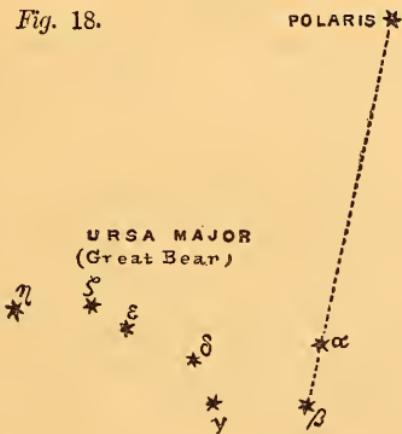
When we see, on a clear night, so many brilliant stars, it may well seem difficult to become acquainted with the various groups, indeed even to learn the names of the more prominent stars; the more so, when we know that the stars which are seen at a given hour any one night, are not all the same as those seen at the same hour on another night, and that the appearance of the firmament is constantly changing.

In consequence of our living on that portion of the earth between the north pole and the equator, the north pole of the heavens does not correspond to our zenith, nor does it lie within our horizon, but it approaches nearer the zenith the smaller our distance is from the north pole of the earth, or it is the more removed from the horizon the farther we are from the equator; hence, any one desirous of becoming acquainted with the heavens has, first of all, to determine where he has to find in the vault of the heavens the visible *pole*. This can be ascertained quite easily, without any special aid from the stars themselves.

The observer has, in the first place, to look in the heavens for the very conspicuous group formed by the seven most brilliant stars of the *Great Bear* (*Ursa Major*). The irregular

square with its accompanying arc of three stars can be easily found in the northern part of the heavens, and recognized again without any trouble. If now he joins the two most brilliant stars of the square by a right line, and prolongs this upward until it reaches the vicinity of a solitary star of the second magnitude, he has discovered in this star the *Polar Star*, which is so called, because it stands quite near the north pole. If now the spectator so places himself that he directly faces this star, then *North* lies before him, *South* behind him, *East* to his right, and *West* to his left.

Fig. 18.



#### Setting of the Celestial Globe. Elevation of the Pole.

In order, by means of the celestial globe to become acquainted with the individual stars and their relative position, it is indispensably necessary to set the globe properly, and to adjust it so as to bring the place in which we are to its polar elevation.

For this purpose, find on the astronomical calendar of the horizon, in what degree of the ecliptic the sun is on the day on which you wish to make observations, and bring this degree under the metal meridian. Place the hour-circle on the number 12, and turn the globe, until the hour at which you are observing, stands on the divided side of the meridian — to the east, if the supposed hour be in the morning; to the west, if it be

in the evening: then the line which you imagine to come from the center of the globe and to pass through a star marked on its surface, and to be produced up to the vault of the sky, will show the spot where that star stands in the heavens. The spectator must always consider himself as in the center of the celestial globe, in order to be able to compare its data directly with the heavens. On the celestial globe all the positions of the stars are reversed; *i. e.* a star which in the heavens is on the spectator's right, must be looked for on the left on the celestial globe.

#### Alignment.

If now we have formed of the chief stars of a constellation which we wish to know more closely any kind of a figure, *e. g.*, a triangle, a square, or something of the sort, then the imaginary lines drawn across the heavens from one star to another will form similar figures; and with the aid of these and other reminders, it will not be hard to stamp upon the mind the relative positions of the stars. This is the usual course adopted to learn the positions of the stars by *alignment*. Thus, for example, opposite the constellation of the Great Bear, on the other side of the north pole, is to be found the well-known constellation *Cassiopea*; and between both constellations on either side of the Polar Star the two stars of the first magnitude, *Vega*, in *Lyra* (the Harp), and *Capella*, in *Auriga*, the former being somewhat more distant from the pole.

By means of the celestial globe, adjusted according to the above directions, we can soon discover the other constellations and their most important stars. Thus, by the prolongation of the crooked tail of the Great Bear, we find *Arcturus*, in *Boötes*; further, in the brilliant constellation of *Orion*, the stars of the first magnitude, *Betelgeuse* and *Rigel*, the glittering *Sirius*, and the dark-red *Aldebaran*, in *Taurus*.

#### Culmination.

During the apparent revolution of the firmament every twenty-four hours, each star arrives at a point at which it

stands at its greatest altitude: this point is called the *Point of Culmination*.

Culmination is distinguished into upper and lower culmination. Whilst each star, in its daily revolution, *twice* passes the plane of the meridian, it thus attains its greatest altitude above the horizon (upper culmination), and twelve hours later its least altitude (lower culmination). In the case of the stars around the poles, we can see both these culminations, inasmuch as these stars are always above the horizon. Most of the other stars sink, after their upper culmination, below the horizon; and, in their case, the lower culmination takes place below the horizon.

Hence a star or planet is said to culminate when it comes to the meridian of any place; for then its altitude at that place is the greatest.

#### Zodiac.

The name *Zodiac* is given to a zone or belt of the heavens,  $16^{\circ}$  wide, extending along the circle of the ecliptic,  $8^{\circ}$  on each side of it. The paths of the principal planets lie within this zone. Its length is divided into twelve signs of  $30^{\circ}$  each, having the same names, and arranged in the same order, as those of the ecliptic, though coincident with them.

The *Diurnal Arc* is the arc described by a heavenly body from its rising to its setting.

The *Nocturnal Arc* is the arc described by a heavenly body from its setting to its rising.

#### Right Ascension and Declination.

*Right Ascension* means the arc drawn upon the celestial equator from the Vernal Equinox toward the east. If one imagine a circle drawn through any star and the two poles, this circle will intersect the equator perpendicularly.

The degrees of right ascension are counted toward the east up to  $360^{\circ}$ ; still it is usually not expressed by degrees, but by the time needed to cross the meridian. In 24 hours, sidereal time, the whole celestial sphere completes one apparent diurnal revolution round the earth.

The *Declination* of a star is its distance from the equator, expressed by the arc of a circle passing through the two poles ( $D S$ ,  $D' S'$ ). If the star is between the equator and the north pole of the heavens, its declination is *north* and is indicated by a + prefixed to it; but if it stands between the equator and the south pole of the heavens, its declination is *south*, and is indicated by the sign—.

The *Right Ascension* and *Declination* of a point in the heavens correspond to the longitude and latitude of a station on the earth; and the place of a star on the celestial globe is determined when the former elements are known, just as that of a town on a map is known by its latitude and longitude.

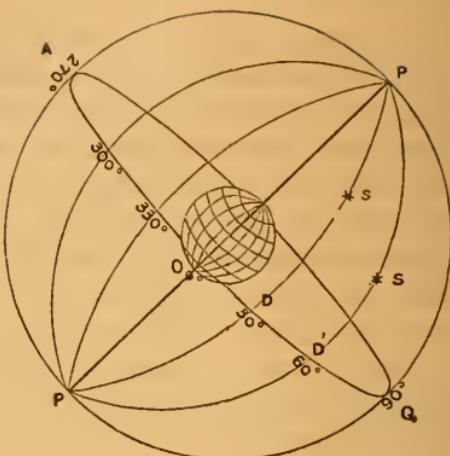
In order to find the *Right Ascension* and *Declination* of the moon or other planet, we have to make use of an *ephemeris*, because these heavenly bodies cannot be marked upon the celestial globe on account of their constant change of position; in this they are unlike the fixed stars, which do not change their position in the heavens.

An *Ephemeris* (Nautical Almanac), or astronomical year-book, is a publication in which the position of the heavenly bodies is given beforehand for a determined period, generally for a year. These books are indispensable to navigators as they serve to state beforehand the appearance of the heavens, and to call attention to it.

#### Azimuth or Vertical Circles.

These are imaginary great circles passing through the zenith and nadir, and intersecting the horizon at right angles. The altitudes of the heavenly bodies are measured on these

Fig. 19.



circles, which may be represented by screwing the quadrant of altitude on the zenith of any place, and making the other end move along the horizon of the globe.

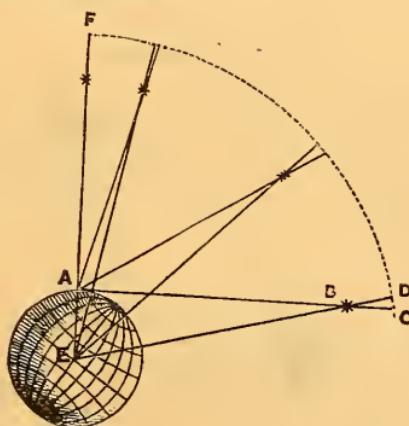
The azimuth is counted from the south point toward the east or west, and generally up to  $180^{\circ}$ . By means of the azimuth and altitude, the position of any star in the heavens for a determinate time is fully defined.

#### Parallax.

*Parallax* is the difference between the altitude of any celestial object seen from the earth's surface, and the altitude of the same object if seen at the same time from the earth's center; it is the angle under which the semi-diameter of the earth would appear if seen from the object.

An object at **B**, viewed from the earth's surface at **A**, appears to be at **C**; viewed from the center of the earth **E**, it would seem to be at **D**.

Fig. 20.



The parallax of a heavenly body is greatest when it is in the horizon, and decreases as the body ascends toward the zenith **F**, at which place it is nothing, its apparent and its true place being the same.

#### The Solar System.

The *Solar System* is an assemblage of heavenly bodies, which consists of the sun and the planets, with their moons or satellites, very many comets, and a large number of meteorites. These bodies revolve around the sun under the operation of the force called gravitation and the centrifugal force,

The *Sun* is the source of light and heat to all the other bodies of the solar system, and the support of life and vegetation on the surface of the earth, or of the other planets. It is the central point of motion for all the principal planets, the comets, and meteorites.

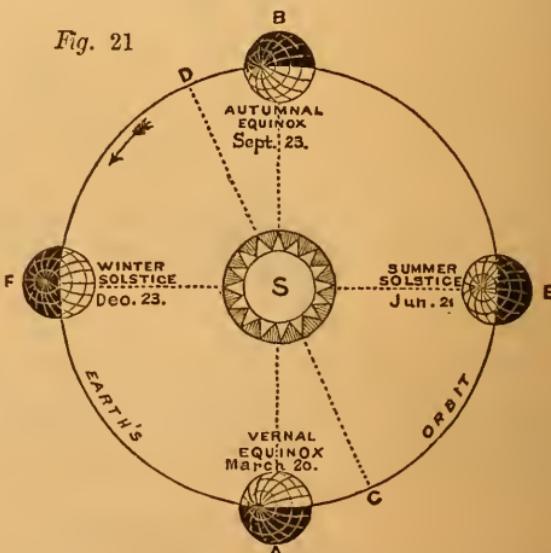
The sun is situated near the center of the orbits of all the planets, and revolves on its axis from west to east in 25 days, 5 hours, and 35 minutes. This rotation, determined from the motion of the spots on the surface of the sun, is from west to east.

The figure of the sun appears to be a perfect sphere, no observations having as yet detected any indication of oblateness. The mass of the sun is 315,000 times as great as that of the earth. The actual diameter of the sun is 852,900 miles, or  $107\frac{3}{4}$  times the diameter of the earth. The inclination of the sun's axis to the ecliptic is  $7\frac{1}{3}^{\circ}$ .

#### Cause of the Seasons.

In the cut, the earth is shown in its orbit, with its axis inclined  $23\frac{1}{2}^{\circ}$ ; the north pole being towards the eye of the observer. At A and B the sun shines from pole to pole, and the days and nights are equal in both hemispheres. On the right, the north pole is in the light, and we have summer in the northern hemisphere. On the left, the reverse is the case. The gradual shortening or lengthening of the days, and the change of temperature, are produced by the passage of the earth from one point to another, with its axis thus inclined.

Fig. 21



#### Description of the Celestial Globe.

In the preceding description of the terrestrial globe, the various parts are accurately described and explained. With few exceptions, the celestial globe has the same fittings; therefore, for the better understanding of those of the celestial globe, the reader is referred to the description of the terrestrial globe, and the individual parts of the celestial globe will be but briefly treated of in the following pages.

The artificial celestial globe is one upon which, together with the chief fixed stars and constellations, the division of the heavens by certain circles is indicated. It thus forms a very efficient aid for the understanding of those circles which astronomers imagine to be drawn upon the vault of the heavens.

In using the celestial globe, the spectator must imagine himself placed at its center in order to be able directly to compare its data with the heavens.

#### Poles.

In the celestial globe, we have first to distinguish the two points of revolution, the north pole and south pole, upon which the globe is made to revolve. Both these points correspond to the poles of the heavens, around which the celestial sphere revolves once in 24 hours.

#### Equator.—Meridians.

Concentric with the poles, there are great circles drawn upon the celestial globe, one of which, being at an equal distance from both poles, is called the *Equator*.

The *Equator* divides the globe into a northern, and a southern hemisphere. Perpendicular to the equator, and passing through both poles, there are on the celestial globe a definite number of great circles, which are called the *Meridians*, or midday circles, *i. e.*, the right ascension circles of the stars.

#### Declination.

Those circles which are drawn upon the globe concentric with the poles, and consequently parallel to the equator, are the *Declination Circles* of the stars, otherwise called their *Diurnal Circles*.

### The Ecliptic.

One great circle which intersects the equator at an angle of  $23\frac{1}{2}^{\circ}$ , represents the *Ecliptic*, or the apparent path of the sun. The ecliptic also divides the celestial globe into two equal parts; in the center of the northern half, lies the north pole of the ecliptic; in the center of the southern half, its south pole.

### Polar Circles.

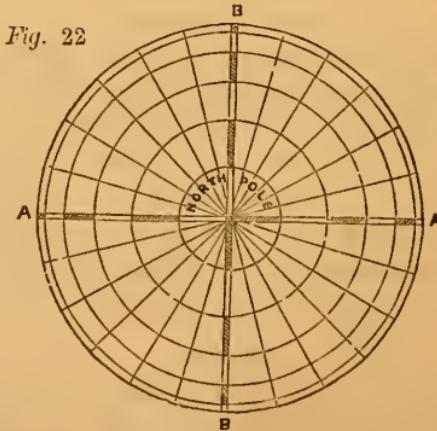
The circle drawn around the north pole of the equator, and passing through the north pole of the ecliptic, is called the *North Polar Circle* (therefore analogous to the like-named circle on the terrestrial globe); a similar circle drawn around the south pole of the celestial equator through the south pole of the ecliptic, is called the *South Polar Circle*. (Fig. 8).

### Tropics.

Two circles parallel to the equator, and distant from it north and south  $23\frac{1}{2}^{\circ}$ , are called the *Tropics* — the northern one, the tropic of cancer; the southern, the tropic of capricorn. (Fig. 8).

### Colures.

Through both poles of the earth there are also drawn two of the great circles, of which one (A A) passes through both the *Equinoctial Points*, the other (B B) through both the *Solstitial Points*. The former is called the *Equinoctial Colure*; the latter the *Solstitial Colure*.



For the description and use of the other parts pertaining to the celestial globe, see the description of the terrestrial globe.

*Problems solved by means of the Celestial Globe.*

PROBLEM I. *To find the Right Ascension and Declination of a heavenly body.*

RULE. Bring the heavenly body under the graduated side of the metal meridian, on which will be found the declination. The number of degrees on the equinoctial (equator) between the meridian and the first degree of the sign Aries will be the right ascension.

PROBLEM II. *To find the Latitude and Longitude of a star.*

RULE. Place the upper end of the quadrant of altitude on the north or south pole of the ecliptic, according as the star is on the north or south side of the ecliptic, and move the other end till the star comes to the graduated edge of the quadrant; the number of degrees between the ecliptic and the star is the latitude, and the number of degrees on the ecliptic, reckoned eastward from the first degree of Aries to the quadrant, is the longitude.

PROBLEM III. *To represent the Appearance of the Heavens at any time.*

NOTE.—In working out these problems the celestial globe must be previously brought to the polar elevation corresponding to the latitude of the place of observation.

RULE. The position of the sun for the day given is first found in the ecliptic ; that place is then brought under the meridian, and the hour-circle is placed upon 12. This position of the celestial globe then gives the position of the stars toward the horizon at noon on that day. Then the celestial globe is turned westward until the hour-circle stands upon the required hour of the evening : the required position of the firmament toward the horizon has then been found.

PROBLEM IV. *To find the time of the rising and setting of any heavenly body on any given day.*

RULE. Having adjusted the globe to the latitude of the given place, bring the sun's place in the ecliptic to the merid-

ian, and set the hour-circle at 12. Turn the globe eastward and then westward, till the given body meets the horizon, and the hour-circle will show the times of rising and setting.

**PROBLEM V.** *To find that place in the horizon where a star rises, and the length of time it remains visible.*

**RULE.** In order to solve this problem, bring the star to the meridian, and place the hour-circle on 12. Then turn the globe, and bring the star to the horizon. The point where the star is situated on the horizon, gives the place of its rising and setting, and the number of the hour-circle shows half the length of time which the star will be above the horizon.

**PROBLEM VI.** *To find the place of the sun's rising and setting and the length of the day.*

**RULE.** For this purpose we mark the sun's position in the ecliptic for the day given, bring this point under the meridian, and then proceed as in the foregoing problem.

**PROBLEM VII.** *To find the Altitude and Azimuth of a star for a given latitude and at a given time.*

**RULE.** Adjust the globe for the aspect of the heavens (Prob. III); screw the quadrant of altitude to the zenith, and direct it through the place of the star. Then the arc between the star and the horizon is the altitude; and the arc of the horizon between the quadrant of altitude and the meridian is the azimuth.

**PROBLEM VIII.** *The Right Ascension and Declination of a star, the moon, a planet, or a comet being given, to find its place on the globe.*

**RULE.** Bring the given degree of right ascension to that part of the meridian which is numbered from the equinoctial (equator) toward the poles; then under the given degree of declination you will find the star or the place of the planet.

**PROBLEM IX.** *The latitude of a place, the day of the month, and the hour being given, to place the globe in such a manner as to represent the heavens at that time, in order to find the relative situations and the names of the constellations and principal stars.*

**RULE.** Take the globe out into the open air on a clear, star-light night, where the surrounding horizon is not interrupted by different objects; elevate the pole to the latitude of the place, and set the globe due north and south by a meridian line, or by a mariner's compass, taking care to make a proper allowance for the deflection; find the sun's place in the ecliptic, bring it to the metal meridian, and set the hour-circle to 12; then, if the time be after noon, turn the globe westward on its axis, till the hour-circle has passed over as many hours as the time is past noon; but if the time be before noon, turn the globe eastward, till the hour-circle has passed over as many hours as the time wants of noon; fix the globe in this position, then the flat end of a pencil being placed on any star on the globe so as to point toward the center, the other end will point to that particular star in the heavens.

**PROBLEM X.** *To find when any star or planet will rise, come to the meridian, and set at any given place.*

**RULE.** Adjust the globe for the place, find the sun's place in the ecliptic, bring it to the meridian, and set the hour-circle to 12. (The right ascension and declination of a planet must be taken from an ephemeris, and its place on the globe must be determined by Prob. XI.) Then, if the star or planet be below the horizon, turn the globe westward till the star or planet comes to the eastern part of the horizon; the hours passed over by the hour-circle will show the time from noon when it rises, and by counting the motion of the globe westward till the star comes to the meridian and to the western part of the horizon successively, the hours passed over by the hour-circle will show the time of culminating and setting.

If the star be *above* the horizon and *east* of the meridian, find the time of rising, culminating, setting, and rising in a similar manner.

If the star be *above* the horizon and west of the meridian, find the time of setting, rising, and culminating by turning the globe on its axis.

PROBLEM XI. *To find the apparent distances of the stars from each other in degrees.*

RULE. Lay the quadrant of altitude over any two stars, so that the division 0 may be on one of the stars ; the degrees between them will show their distance, or the angle which these stars subtend as seen by a spectator on the earth.

PROBLEM XII. *Given the latitude of a place and the day of the month, to find what planets will be above the horizon after sunset.*

RULE. Elevate the pole as many degrees above the horizon as are equal to the latitude of the place ; find the sun's place in the ecliptic, and bring it to the western part of the horizon, or to ten or twelve degrees below; then look in the ephemeris for that day and month, and you will find what planets are above the horizon. Such planets can be well observed on that day.

PROBLEM XIII. *To find the day of the year on which any given star passes the meridian at any given hour.*

RULE. Bring the given star to the graduated edge of the meridian, and set the hour-circle at 12. If the given hour be before noon, turn the globe westward, but if after noon, eastward, until the hour-circle has passed under the meridian as many hours as the given hour wants of noon. The required day will be found on the ecliptic where the latter is crossed by the meridian.

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**The SCHEDLER**

**GLOBES, TELLURIANS,**

**AND MAPS,**

PUBLISHED BY

**E. STEIGER,**

25 PARK PLACE,

**NEW YORK.**

## NOTICE.

In addition to the Medals received at the International Exhibitions of 1867, 1873, and 1876, the SCHEDLER Globes have been awarded two Medals at the Paris Exposition Universelle of 1878; they are, in fact, **the only American Globes** that were distinguished by the award of Medals at Paris, Vienna, and Philadelphia.

Notwithstanding these public successes, and the sincere and substantial appreciation of practical educators, no effort will be spared to secure for the SCHEDLER Globes, by incessant improvement, the lasting favor of a discriminating public.

---

"A Globe is as essential in a School-room  
as a Blackboard or a Dictionary."

## THE SCHEDLER TERRESTRIAL AND CELESTIAL GLOBES.

In view of the growing interest in matters of Geography and Travels, it may seem needless nowadays to enlarge upon the value and advantages of Globes as means of instruction, and the more so as, apart from their general introduction into schools, they are fast becoming favorites in private libraries and parlors, with a fair prospect that they will, in time, be regarded as among the necessities in every well-furnished home. It will not, however, be considered out of place to enumerate here some of their special advantages.

The Globe is the truest, most natural, and indeed, cartographically speaking, the **only accurate** representation of the Earth. All flat map projections must necessarily contain errors, which will increase in proportion to the area of the Earth's surface which they are intended to represent. The Mercator projection, if the ends of a Map of the World are joined together, produces a cylinder, and, in different latitudes, presents widely different scales. If we place side by side planiglobes based on other projections, they touch each other only at one point (when in fact they should touch each other at all points of the periphery), and give the countries according to widely differing scales, or, in a measure, distorted and disarranged.

The Globe is, consequently, a most important and, indeed, an **indispensable auxiliary** in geographical instruction ; where the means will permit, the **Relief** Globe, on account of its manifest pre-eminence, should be used.

Only upon the Globe can the teacher present to the pupil the whole Earth in its natural form.

On the Globe can easily be explained those points and mathematical lines which require elucidation as being the groundwork of Geography : the poles, the meridians, the parallels, the equator, the tropics, the polar circles, and the ecliptic.

On the Globe the teacher can readily explain the lighting of the Earth at different times of the day ; the diurnal revolution of the Earth, the synchronism of sunrise, midday, and sunset in any two given places upon the same meridian, the difference of the time of day between places not upon the same meridian. All this the pupil can see with his own eyes, and, therefore, thoroughly understand.

On a Globe provided with a Meridian, the lighting and heating of the Earth at various seasons may be demonstrated ; and, in connection therewith the climatic differences of the zones, the trade-winds, the winds arising from climatic differences, as the monsoons, etc., may all be explained.

On the Globe we can learn the real form of countries and seas. There is not a flat map of the Pacific or Atlantic Ocean which is correct in every direction and in all points ; their representation on a flat surface makes errors inevitable. Consequently on a Globe the great lines, too, of transmarine trade, of circumnavigation, of the telegraphs encircling the whole Earth, are traced with certainty and accuracy.

It is true that the larger Globes have some slight drawbacks, inasmuch as they cannot be put into the pupil's hands, and the minuteness of the drawing and names makes their study from a distance impossible. This little difficulty has been surmounted. For the demonstration of problems, etc., the teacher uses the largest Globe at command. Pupils have Globes of small size in their hands. These small Globes are very cheap, and contain, in the main, every thing necessary for elucidating the elementary principles of general mathematical Geography. They give also the chief countries and seas, and the lines of circumnavigation.

Whilst the foregoing applies with special reference to Terrestrial Globes, it is needless to mention that the same principles hold good in regard to Celestial Globes.

The more advanced pupil will also find the **Tellurian** a valuable aid in the study of Mathematical Geography. The synchronism and regularity of the Earth's revolution on its axis, as well as of its revolution round the Sun, and of the Moon's revolution round the Earth, may be traced and understood in every phase by this apparatus. Above all, this is the most direct and practical means of making evident to the pupil the eclipses of the Sun and the Moon, the inclination of the Earth's axis to its orbit, etc.

As regards the **SCHEDLER** Globes, there need be no longer any hesitation in claiming that they are

### **absolutely the best Globes in the market.**

In support of this assertion the following statement is submitted :

It is universally conceded that the Centennial Exhibition at Philadelphia, 1876, furnished an opportunity which producers all over the world had desired — the opportunity to test by actual comparison the respective merits of their several manufactures or productions. As a consequence, nearly every nation was there represented by the best it had to offer, and individual exhibitors were as a rule, confident that their goods, which had been forwarded for competition at great expense, would

surpass all similar displays. On the other hand, articles or manufactures concerning the absolute superiority of which any doubt existed, were wisely kept at home to avoid unnecessary expense and possible defeat. On the whole, therefore, we may regard the material placed on exhibition at Philadelphia as the world's best.

Many Terrestrial and Celestial Globes are being produced both in America and Europe, and yet, only a few publishers ventured to send even the choicest of these to the Centennial. Upon a careful comparison the SCHEDLER Globes were admitted by all to be by far the finest on exhibition. This popular verdict was officially sustained, after a thorough examination, by the judges, and, as a result, SCHEDLER'S were the only Terrestrial and Celestial Globes that received an award at the Philadelphia Exhibition.

The judges recommended them for the following reasons:

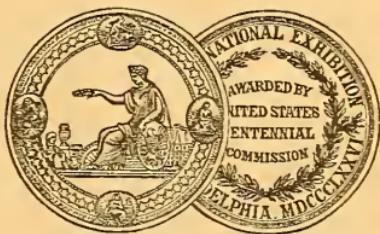
*"Excellence of Work,  
Delicacy of Finish,  
Accuracy of Adjustments,  
Freshness of Detail,  
Economy of Cost."*

In addition to these qualities, another point might have been mentioned, viz.: the unsurpassed variety of styles and sizes, for the display of the SCHEDLER Globes comprised no less than 60 different numbers, *i. e.* more than all the other exhibits of Globes combined, a fact which shows that the wants and tastes of all classes of purchasers have been studiously considered.

The excellency of the SCHEDLER Globes, thus again officially recognized, had long been acknowledged. They received the First Prize at the

Paris Exposition of 1867, and subsequently the Medal of Merit, at Vienna, 1873, at which time they entered the field against all their European competitors. Since then they have steadily increased, alike in quality and in extent of variety, so that, being offered in more than 70 different numbers, they now

constitute absolutely the largest assortment of sizes and styles of any one make, either in America or in Europe. In their prominent features,



Beauty of Workmanship, Completeness and Accuracy of the Drawings  
Durability and Cheapness, as well as in minor matters, they are not only  
unexcelled — they are unrivaled.

It is truly said of them that they combine extreme lightness with the greatest possible durability; they supply the maximum of information compressible within their space, and yet extreme clearness is every-where observable; they are produced by a patented process at prices which place them within the reach even of those of modest means.

It is a fact that much attention is now being devoted to the matter of improved School Apparatus, and that school officers and educators are making careful selections in this line — inferior articles being considered too dear at any price.

A consequence of this is that universal attention has been attracted and secured to the SCHEDLER Globes. They are now being, more than ever before, closely examined and carefully compared with others, and the uniform result is that they are unhesitatingly preferred not only on account of their excellence, but also of their cheapness.

It is especially important that new geographical discoveries and territorial changes be promptly reproduced on the Globes. This is being constantly done on the SCHEDLER Globes, and thus, for instance, the discoveries of such explorers as Stanley, the changes of sovereignty in Eastern Europe, the re-adjustments of territorial lines in Africa and Asia, and similar signs of historical progress are indicated upon them as soon as made known (This was one of the points of preference which secured to them special recognition at the Paris Exposition, 1878.) In addition to this the peculiar composition of these Globes, their material and mounting, render them proof against all climatic changes or influences (a feature which other Globes do not possess), and they are, consequently, especially adapted for export to foreign countries in which such atmospheric inconveniences occur.



It is worthy of note that after receiving — alone of all American Globes — **Medals** at the last **four International Exhibitions** (1867, 1873, 1876, and 1878),



the SCHEDLER Globes have been awarded (November 23rd, 1878) the  
**Medal of Superiority**

by the Directors of the American Institute, New York, upon the following Report of the Judges:

*"We consider these Globes the best and most perfect manufactured, and exceedingly accurate in the geographical drawings."*

As indicative of the general favor with which the SCHEDLER Twenty-inch Globes are being regarded, the fact is here mentioned that they are in use

in the Library of the President, the Office of the Postmaster-General,  
the Bureau of Education, and other Offices at Washington,  
in the Post-Office, and the Rooms of the  
American Geographical Society of New York,  
in a number of Public Libraries,  
in Colleges and other Educational Institutions,  
in Banking, Insurance, Consular, and other Offices,  
and in a large number of Private Residences,  
where they are justly considered

**both useful and ornamental.**

Upon a careful comparison with the numerous other Globes now in the market, the SCHEDLER Twelve-inch Globes are being regarded as the best and yet cheapest of all for Public Schools and Private Educational Institutions, and, as one instance, it may here be mentioned that within a few months more than 60 have been purchased for the schools of one city alone.

## THE TWENTY-INCH TERRESTRIAL GLOBES.

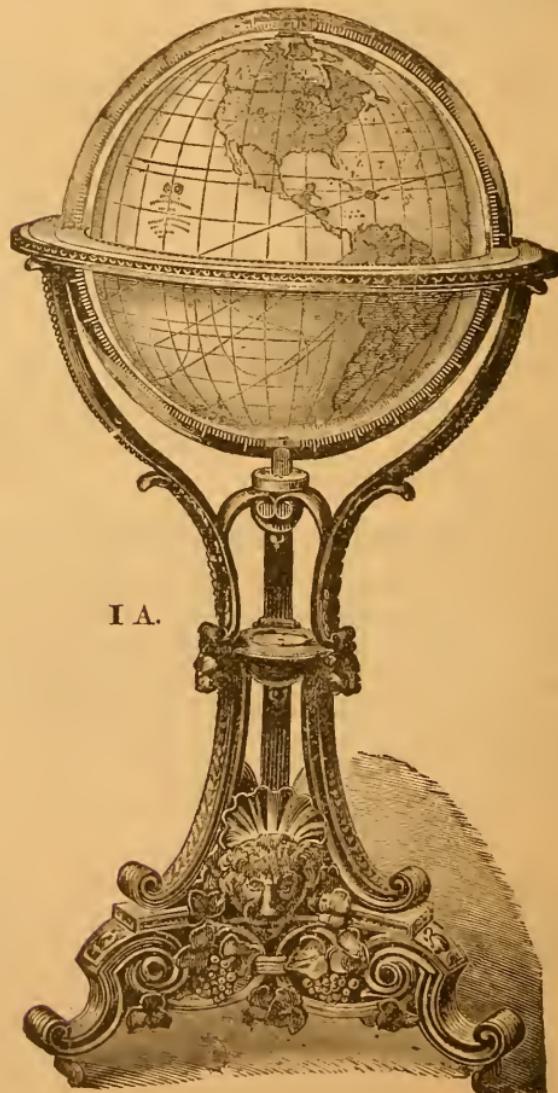
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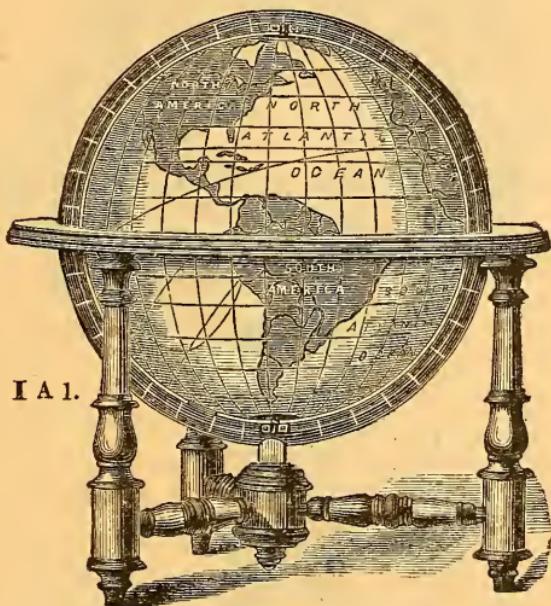
*The Parlor Globe.*

(A beautiful ornament for the Parlor or Library.)

NOTE.—The prices within brackets [ ] denote the extra cost of packing.



**I A.** **The Parlor Terrestrial Globe. Complete.** On fine bronzed pedestal-frame, 42 inches high. With horizon, brass meridian divided into half degrees, hour-circle, quadrant, and magnetic needle. \$165.00 [\$3.00]

**I A 1.**

**I A 1. The Parlor Terrestrial Globe. Complete.** On low frame of black polished wood. With horizon, (cast-iron, nickel-plated) meridian divided into half-degrees, hour-circle, and quadrant.

\$80.00 [\$2.50]

(This style, with brass meridian, \$15.00 extra.)

### *The Scientific Globe.*

This is the most elaborate Globe ever produced. Not only does it give the latest authenticated discoveries in various parts of the World, but, in addition, it contains a large fund of interesting information on physical matters.

It contains the Lines of Ocean Steam Communication and Overland Routes, the great overland and submarine Telegraph Lines, and the principal Tracks of Sailing Vessels; showing the directions and mean velocity of the Ocean Currents, important Deep Sea Soundings, also the Equal Magnetic Variations.



II A.  
III A.

**II A.** The Scientific Terrestrial Globe. Complete. On bronzed pedestal-frame, 42 inches high. With horizon, (cast-iron, nickel-plated) meridian divided into half-degrees, hour-circle, and quadrant.      \$75.00    [\$3.00]



II B.  
III B.

**II B. The Scientific Terrestrial Globe.** With full meridian. On bronzed pedestal-frame with full (cast-iron) meridian, and inclined axis. \$60.00 [\$2.50]

**II C. The Scientific Terrestrial Globe.** Plain. On bronzed iron stand, with inclined axis. \$55.00 [\$1.50]

*The High School Globe.*

In size, form, and fixtures, this Globe is similar to the **Scientific Globe**.

It is specially designed for the use of Colleges and High Schools. All matters represented and all names, notwithstanding their multiplicity, are kept clear and distinct, and confusion is avoided. By it the fundamental and elementary principles of geography, so difficult to the learner, are readily explained. The most important rivers, capital cities, and mountain ranges, are given as distinctly as possible. This Globe, therefore, commends itself to parents and teachers as an essential aid in instruction. Its practical utility can not fail to be recognized in Schools; it has already been received with great favor by eminent instructors in many of our Normal and High Schools, who have strongly testified to its value; and it may be confidently offered as better adapted for the instruction of youth than any Terrestrial Globe hitherto constructed.

**III A. The High School Terrestrial Globe. Complete.** On bronzed pedestal-frame, 42 inches high. With horizon (cast-iron, nickel-plated) meridian divided into half-degrees and hour-circle. \$60.00 [\$3.00]

**III B. The High School Terrestrial Globe.** With full meridian. On bronzed pedestal-frame, with full meridian, and inclined axis. \$45.00 [\$2.50]

**III C. The High School Terrestrial Globe.** Plain. On plain iron stand, with inclined axis.

\$40.00 [\$1.50]



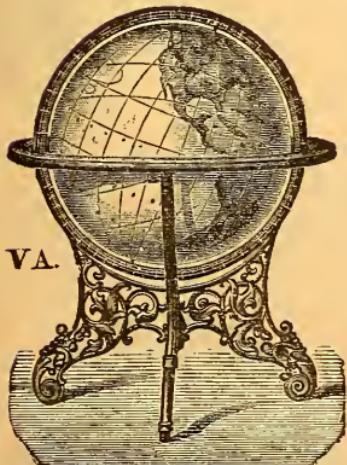
SIXTEEN-INCH TERRESTRIAL GLOBES  
are in preparation.

---

THE TWELVE-INCH TERRESTRIAL GLOBES.

Beautifully printed in colors, the Water blue, the Ocean Currents white, indicating the principal lines of Ocean Steam Communication, and the Submarine Telegraph Cables.

*The Cabinet Terrestrial Globe.*



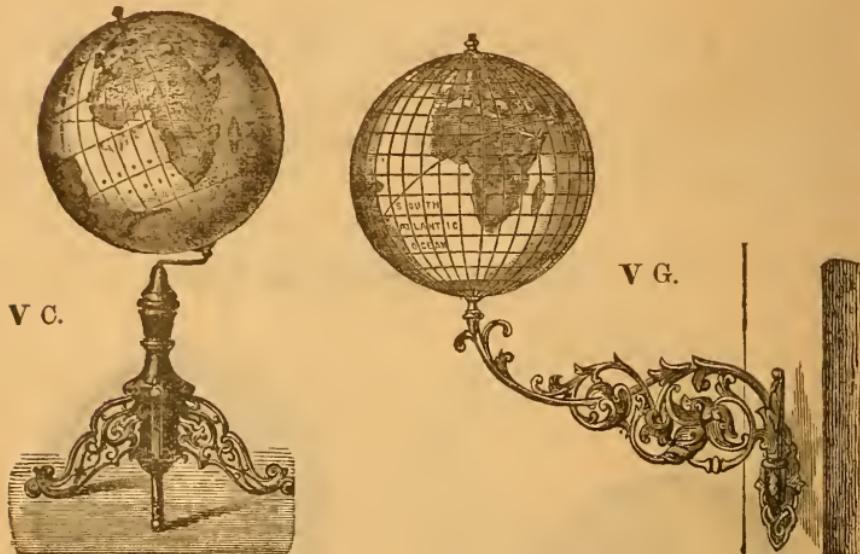
V A. The Cabinet Terrestrial Globe. Complete. On low bronzed frame, with horizon, meridian, hour-circle, and quadrant.

\$22.00 [\$1.00]

V B. The Cabinet Terrestrial Globe. With full meridian. On bronzed stand, with full meridian, and inclined axis. \$16.00 [\$0.90]

**V C.** The Cabinet Terrestrial Globe. Plain. On low bronzed stand, with inclined axis. \$14.00 [\$0.80]

**V G.** The Cabinet Terrestrial Globe. On bronzed hinged bracket. \$10.00 [\$0.80]



### *The Twelve-inch Terrestrial School Globe.*

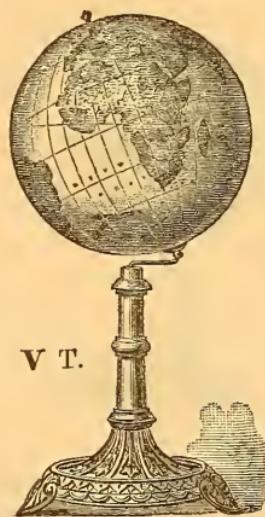
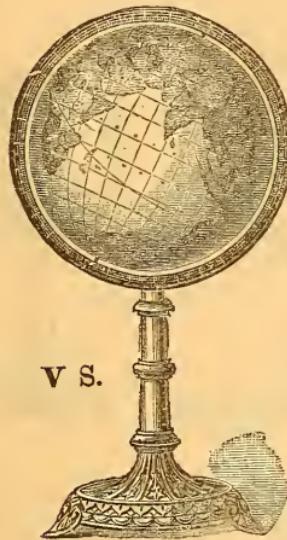
(The Ball of this School Globe is the same as that of the Cabinet Globe.)

**V R.** The Twelve-inch Terrestrial School Globe. Complete. On low cast-iron and walnut frame, with horizon, meridian, and hour-circle. \$18.00 [\$1.00]

**V S.** The Twelve-inch Terrestrial School Globe. With **V R.** full meridian. On cast-iron and walnut stand, with full meridian and inclined axis. \$15.00 [\$0.90]



**V T.** The Twelve-inch Terrestrial School Globe. Plain. On cast-iron and walnut stand, with inclined axis. \$12.00 [\$0.80]



### THE NINE-INCH TERRESTRIAL GLOBES.

**VI A.** The Nine-inch Terrestrial Globe. Complete. On low iron frame, with horizon, meridian, hour-circle, and quadrant. \$15.00 [\$0.60]

**VI B.** The Nine-inch Terrestrial Globe. With full meridian. On low iron stand, with full meridian, and inclined axis. \$11.00 [\$0.50]

**VI C.** The Nine-inch Terrestrial Globe. Plain. On plain iron stand, with inclined axis. \$9.00 [\$0.50]

**VI G.** The Nine-inch Terrestrial Globe. On bronzed hinged bracket. \$6.00 [\$0.50]

#### *The Nine-inch Terrestrial School Globe.*

(The Ball is the same as that for **VI A**, **VI B**, **VI C**, etc., — but the Mounting is similar to that of **V R**, **V S**, **V T**, respectively.)

**VI R.** The Nine-inch Terrestrial School Globe. Complete. On low cast-iron and walnut frame, with horizon, meridian, and hour-circle. \$12.00 [\$0.60]

**VI S.** The Nine-inch Terrestrial School Globe. With full meridian. On cast-iron and walnut stand, with full meridian, and inclined axis. \$10.00 [\$0.60]

**VI T.** The Nine-inch Terrestrial School Globe. Plain. On cast-iron and walnut stand, with inclined axis. \$8.00 [\$0.50]

## THE SIX-INCH TERRESTRIAL GLOBES.



VII A.



VII B.



VII C.

**VII A. The Six-inch Globe. Complete.** On low iron frame, with horizon, meridian, and hour-circle.                                    \$8.00    [\$0.35]

**VII B. The Six-inch Globe. With full meridian.** On low iron stand, with full meridian, inclined axis.                                    \$4.50    [\$0.52]

**VII C. The Six-inch Globe. Plain.** On low iron stand, with inclined axis.    \$3.50    [\$0.25]

**VII D. The Six-inch Globe. In Paper Box.**  
(The Globe, when used, to be put on  
the top of the Box.)    \$2.50    [\$0.20]

**VII E. The Hand Hemisphere Globe.**  
With hinge.    \$3.00    [\$0.25]

**VII F. The Wall Hemisphere Globe.**  
Planisphere Maps and Hemisphere Globes  
combined. Mounted on pasteboard.  
    \$3.75    [\$0.40]

**VII G. The Six-inch Globe.** On bronzed  
hinged bracket.    \$3.00    [\$0.20]



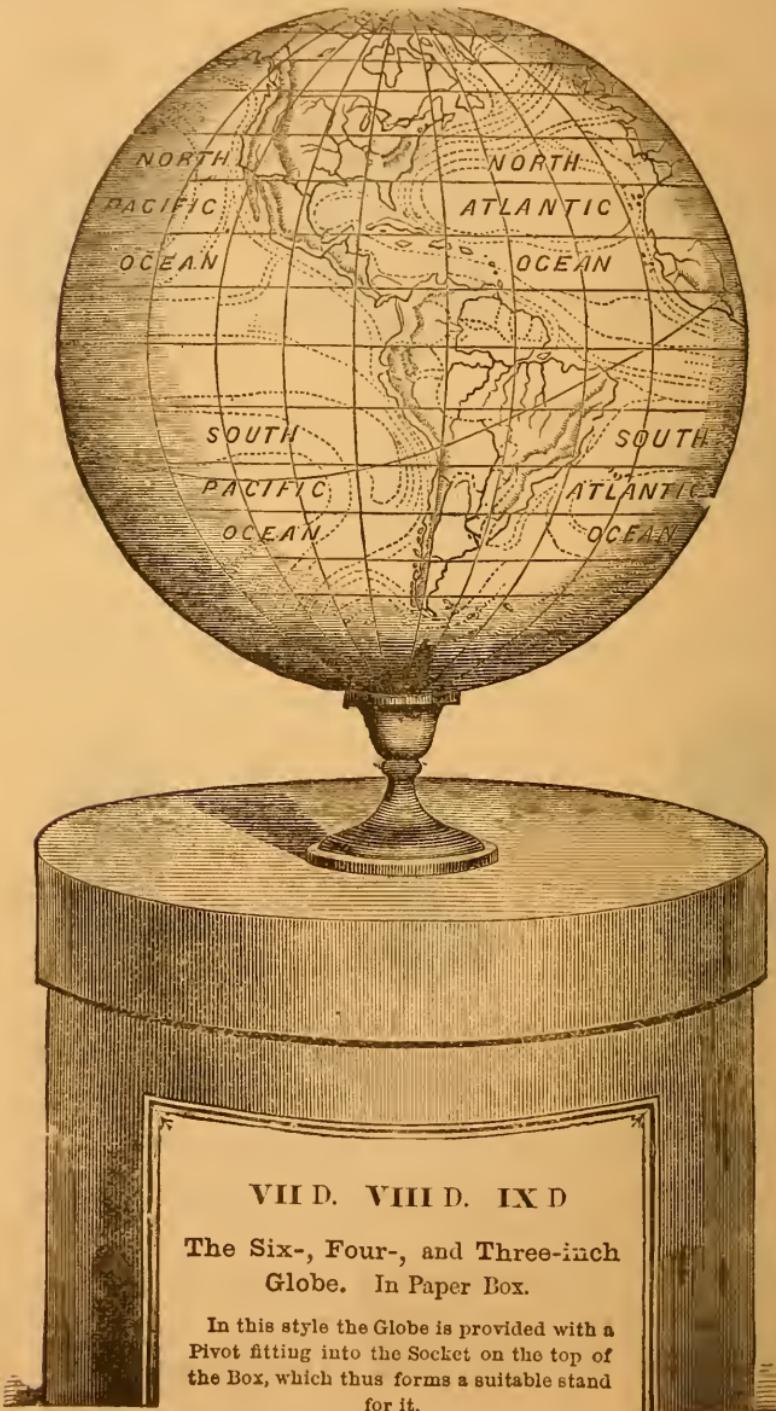
## THE FOUR-INCH TERRESTRIAL GLOBES.

<b>VIII B.</b> The Four-inch Globe.	With full meridian.	On low iron stand, with full meridian, and inclined axis.	\$3.00	[\$0.20]
<b>VIII C.</b> The Four-inch Globe.	Plain.	On low iron stand.	\$2.50	[\$0.15]
<b>VIII D.</b> The Four-inch Globe.	In Paper Box.	(The Globe, when used, to be put on the top of the Box.) <i>The Family Globe.</i>	\$1.75	[\$0.15]
<b>VIII G.</b> The Four-inch Globe.		On bronzed bracket.	\$2.50	[\$0.15]
<b>VIII I.</b> The Four-inch Globe.		Loose on bronzed basket-stand.	\$3.00	[\$0.15]

## THE THREE-INCH TERRESTRIAL GLOBES.

**IX B.****IX C 2.****IX D.**

<b>IX B.</b> The Three-inch Globe.	With full meridian.	On low iron stand, with full meridian, and inclined axis.	\$2.00
<b>IX C 1.</b> The Three-inch Globe.	Plain.	On iron stand.	\$1.25
<b>IX C 2.</b> The Three-inch Globe.	Plain.	On neat low iron stand, to be used as a desk-weight.	\$1.25
<b>IX D.</b> The Three-inch Globe.	In Paper Box.	(The Globe, when used to be put on the top of the Box.)	\$1.20
<b>IX G.</b> The Three-inch Globe.		On bronzed bracket.	\$1.50



VII D. VIII D. IX D

The Six-, Four-, and Three-inch  
Globe. In Paper Box.

In this style the Globe is provided with a  
Pivot fitting into the Socket on the top of  
the Box, which thus forms a suitable stand  
for it.

## THE SCHEDLER CELESTIAL GLOBES.

The most difficult task in the preparation of a Celestial Globe is to present clearly the **configurations** of the stars and the **constellations** as two distinct subject-matters.

To effect this, the SCHEDLER Celestial Globes are printed in a manner never hitherto adopted. The stars are printed in **black** upon a **sky-blue** ground, so that their configuration strikes the eye forcibly and at once. The figures of the constellations, and the various designations of the stars by letters, numbers, etc., are printed in **purple**. This method of printing completely obviates the indistinctness and confusion otherwise certain to arise from the multiplicity of objects delineated.

The several subjects are at once grasped by the eye, and present, at the same time, a very beautiful appearance.

These Globes are, moreover, eminently conspicuous for their accuracy, clearness, and elegance: indeed, taking into account their manifold and acknowledged superiority, it may fairly be stated that never have any of equal excellence been offered to the public.

All the Celestial Globes hitherto published are so overcrowded, and the various subjects are so confused, that the very first essential of a Celestial Globe, viz., to present, as totally distinct, the **configuration** of the stars and the **constellations**, is utterly wanting.

Mr. SCHEDLER's aim was to remove these drawbacks, and he has completely succeeded in producing Celestial Globes which will prove valuable auxiliaries as well to the accomplished astronomers as to the tyro.

To delineate in a specially characteristic manner, and to throw into relief by color, the various celestial signs, as usually done, is a complete mistake. These uncouth figures detract from the impression which should be created by the outlines of the stars themselves, and are rather prejudicial than favorable to instruction. They form a misleading medley of figures which is simply annoying and confusing, since no possible assistance is given to one desirous of studying the heavens, by the figure of a "Hercules' club" or a "crown of Cepheus." Such odd figures of constellations are only a remainder of the uncultivated spirit of antiquity, which strove thereby to aid the memory in astronomical studies.

(SIR JOHN F. W. HERSCHEL says in his *Outlines of Astronomy*: "Those uncouth figures and outlines of men and monsters, which are usually scribbled over Celestial Globes and Maps and serve, in a rude and barbarous way, to enable us to talk of groups of stars, or districts in the heavens, by names, absurd or puerile in their origin, are entirely arbitrary, and correspond to no *natural* sub-divisions or groupings of the stars. Astronomers treat them lightly or altogether disregard them."

"This disregard is neither supercilious nor causeless. The constellations seem to have been almost purposely named and delineated to cause as much

confusion and inconvenience as possible. Innumerable snakes twine through long and contorted areas of the heavens, where no memory can follow them; bears, lions, and fishes, large and small, northern and southern, confuse all nomenclature, etc., etc."

The most patient care has been bestowed upon these Globes; they contain, too, the latest results of Astronomical Science, as given by the best authorities.

In their preparation, Mr. SCHEDLER has enjoyed the rare advantage of the advice and suggestions of our eminent astronomer, Prof. PETERS, of the Clinton Observatory.

The SCHEDLER Celestial Globes give all the stars visible to the naked eye up to the sixth magnitude. The signs indicating magnitudes are given in true and natural proportions, and in such a manner as to preclude all mistakes.—The Greek and Roman letters refer to BAYER's classification of stars; the numbers are arranged according to the Catalogues of FLAMSTEED, PIAZZI, BRADLEY, HEVELIUS, and LA CAILLE. The double stars are from Sir FRED. W. HERSCHEL and STRUVE; the magnitudes given are according to ARGELANDER, reduced to the year 1870.

The fittings of the three sizes of Celestial Globes, now published, are exactly similar to those of the corresponding sizes and styles of Terrestrial Globes: thus, those desirous of procuring them **in pairs**, can have them precisely matching each other.

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## THE TWENTY-INCH CELESTIAL GLOBES, to match the TWENTY-INCH TERRESTRIAL GLOBES.

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### *The Parlor Celestial Globe.*

I\* A. **The Parlor Celestial Globe. Complete.** On fine bronzed pedestal-frame, 42 inches high. With horizon, brass meridian divided into half-degrees, hour-circle, quadrant and magnetic needle. \$165.00 [\$3.00]

I\* A 1. **The Parlor Celestial Globe. Complete.** On low frame of black polished wood. With horizon, (cast-iron, nickel-plated) meridian divided into half-degrees, hour-circle, and quadrant. \$80.00 [\$2.50]  
(This style with brass meridian, \$15.00 extra.)

### *The University Celestial Globe.*

II\* A. **The University Celestial Globe. Complete.** On bronzed pedestal-frame, 42 inches high. With horizon, (cast-iron, nickel-plated) meridian divided into half-degrees, hour-circle, and quadrant. \$75.00 [\$3.00]

**II\* B.** **The University Celestial Globe.** With full meridian. On bronzed pedestal-frame, with full (cast-iron) meridian, and inclined axis. \$60.00 [\$2.50]

**II\* C.** **The University Celestial Globe. Plain.** On plain iron stand, with inclined axis. \$55.00 [\$1.50]

### *The High School Celestial Globe.*

**III\* A.** **The High School Celestial Globe. Complete.** On bronzed pedestal frame, 42 inches high. With horizon, (cast-iron, nickel-plated) meridian divided into half-degrees, and hour-circle. \$60.00 [\$3.00]

**III\* B.** **The High School Celestial Globe.** With full meridian. On bronzed pedestal-frame with full meridian, and inclined axis. \$45.00 [\$2.50]

**III\* C.** **The High School Celestial School. Plain.** On plain iron stand, with inclined axis. \$40.00 [\$1.50]

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## SIXTEEN-INCH CELESTIAL GLOBES are in preparation.

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THE TWELVE-INCH CELESTIAL GLOBES,  
to match the TWELVE-INCH TERRESTRIAL GLOBES.

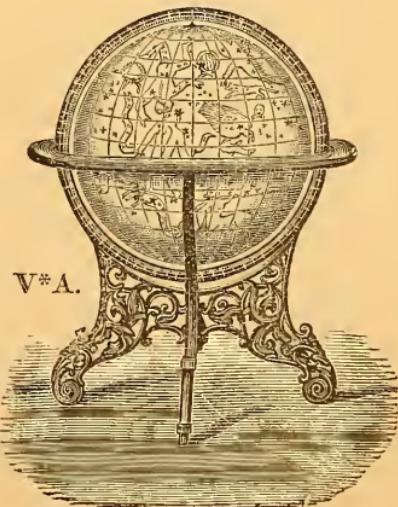
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### *The Cabinet Celestial Globe.*

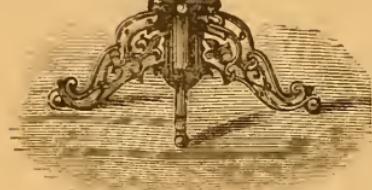
**V\* A.** **The Cabinet Celestial Globe. Complete.** On low bronzed frame, with horizon, meridian, hour-circle, and quadrant. \$22.00 [\$1.00]

**V\* B.** **The Cabinet Celestial Globe. With full meridian.** On bronzed stand, with full meridian, and inclined axis. \$16.00 [\$0.90]

**V\* C.** **The Cabinet Celestial Globe. Plain:** On low bronzed stand, with inclined axis. \$14.00 [\$0.80]



**V\* G.** The Cabinet Celestial Globe On bronzed hinged bracket. \$10.00 [\$0.80]

**V\* B.****V\* C.**

### *The Twelve-inch Celestial School Globe.*

(The Ball is the same as that for **V\* A**, **V\* B**, **V\* C**, etc., — but the Mounting is similar to that of **V R**, **V S**, **V T**, respectively.)

**V\* R.** The Twelve-inch Celestial School Globe. Complete. On low cast-iron and walnut frame, with horizon, meridian, and hour-circle. \$18.00 [\$1.00]

**V\* S.** The Twelve-inch Celestial School Globe. With full meridian. On cast-iron and walnut stand, with full meridian, and inclined axis. \$15.00 [\$0.90]

**V\* T.** The Twelve-inch Celestial School Globe. Plain. On cast-iron and walnut stand, with inclined axis. \$12.00 [\$0.80]

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### THE NINE-INCH CELESTIAL GLOBES, to match the NINE-INCH TERRESTRIAL GLOBES.

**VI\* A.** The Nine-inch Celestial Globe. Complete. On low iron frame, with horizon, meridian, hour-circle, and quadrant. \$15.00 [\$0.60]

<b>VI* B.</b> <b>The Nine-inch Celestial Globe.</b> With full meridian. On low iron stand, with full meridian, and inclined axis.	\$11.00 [\$.50]
<b>VI* C.</b> <b>The Nine-inch Celestial Globe.</b> Plain. On plain iron stand with inclined axis.	\$9.00 [\$.50]
<b>VI* G.</b> <b>The Nine-inch Celestial Globe.</b> On bronzed hinged bracket.	\$6.00 [\$.50]

### *The Nine-inch Celestial School Globe.*

(The Ball is the same as that for **VI\* A**, **VI\* B**, **VI\* C**, etc.,— but the Mounting is similar to that of **VR**, **VS**, **VT**, respectively.

<b>VI* R.</b> <b>The Nine inch Celestial School Globe.</b> Complete. On low cast-iron and walnut frame, with horizon, meridian, and hour-circle.	\$12.00 [\$.60]
<b>VI* S.</b> <b>The Nine-inch Celestial School Globe.</b> With full meridian. On cast-iron and walnut stand, with full meridian, and inclined axis.	\$10.00 [\$.50]
<b>VI* T.</b> <b>The Nine-inch Celestial School Globe.</b> Plain. On cast-iron and walnut stand, with inclined axis.	\$8.00 [\$.50]

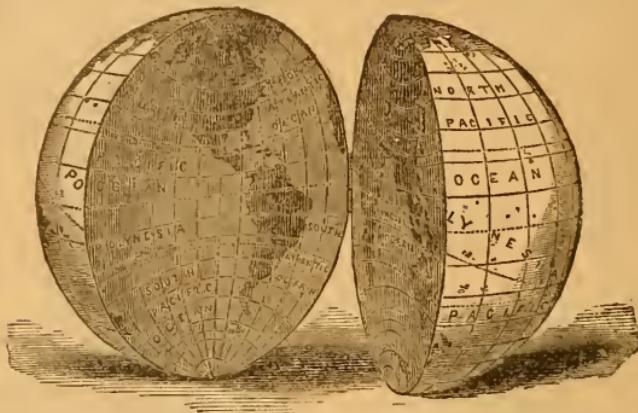
### HEMISPHERE TERRESTRIAL GLOBES, OF 6 INCHES DIAMETER.

The two styles of Hemisphere Globe mentioned below are a most important addition to cheap school apparatus. In both, the arrangement at once shows the learner why the lines on a map must be curved; how impossible it is to depict perfectly any part of the Globe on a flat Map, or to represent on such a map, in their correct form, and in complete unity, countries and seas in their natural proportions, position, distances, etc. For it is clear that a sphere or part of a sphere cannot be accurately represented upon a flat surface. The juxtaposition of the Hemisphere Globe with the Planisphere Map proves this to evidence, inasmuch as the comparison of the two shows very distinctly how distorted and disarranged all the parts of the Earth appear upon the Planisphere Map.

**VII E.** **The Hand Hemisphere Globe.** With hinge. \$3.00 [\$.25]

This style consists of two half-globes, or hemispheres, connected by a hinge. When closed, they form a handy little globe; when opened, the planiglobes are found inside.

Beyond the above mentioned advantages, the **Hand Hemisphere** Globe is extremely useful in the school-room. It can be passed from hand to hand, whilst the teacher is explaining the lesson: it is light, and yet so strongly made that no amount of ordinary wear and tear will affect it, and besides being really hard to break, it is extremely cheap.



### *The Wall Hemisphere Globe.*

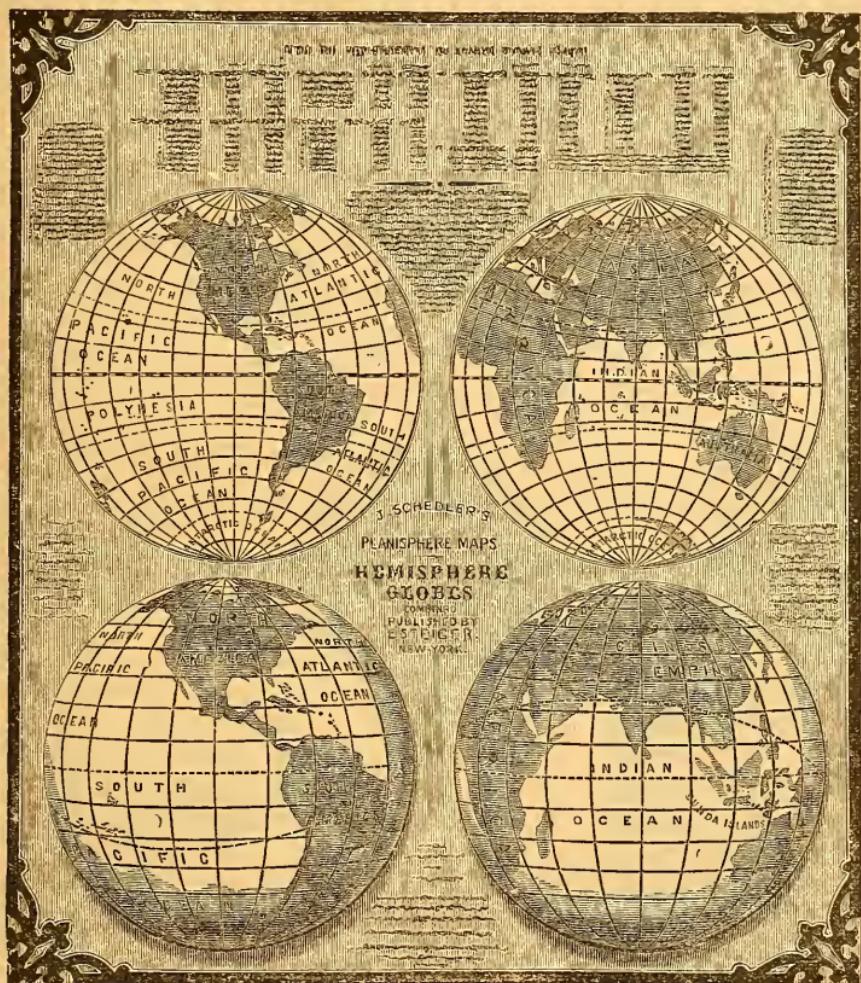
(Patented October 21st, 1873.)

VII F. Planisphere Maps and Hemisphere Globes combined  
Mounted on pasteboard. \$3.75 [\$.40]

In this style the two hemispheres are mounted side by side on pasteboard, the two planiglobes being placed above them. The **Wall Hemisphere Globe** can thus be hung on the wall of a study or school-room, and, whilst forming a very attractive ornament, it is a very compendious, albeit a diminutive, repertory of geographical and other information, as the available space on the mounting is occupied with statistics of prime importance to the beginner in geography.

These statistics comprise the area and population of the various States and Territories of the Union in 1870; the population of thirty of the chief cities in the United States; the area and population of the various continents; the area and population of the main divisions of the American Continent, and other leading geographical data.

Besides the foregoing, the **Wall Hemisphere Globe** has another very strong recommendation, viz. its very low price, which makes it peculiarly adapted for general use, as there is not a single school in the country which cannot afford to provide itself with at least one of these Globes.

*The Wall Hemisphere Globe.*

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THE BRACKET-GLOBES.

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This is a novel and most advantageous method of mounting the Globe.

For Common Schools, in which the teacher is not, as a rule engaged in problems requiring the Globe to have stand, meridian, horizon, etc., this is the best kind.

The teacher needs an inexpensive Globe which can be placed beyond the reach of the scholars and the danger of accidental damage, can be readily taken down and handed round the class, and as quickly put

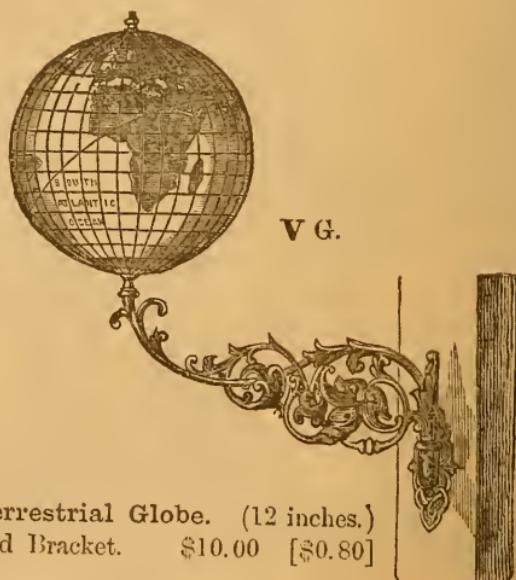
back in its proper place. All these requirements will be found fully met in the Bracket-Globe, of which five different sizes are offered.

The Bracket-Globe will be found, too, a very useful and elegant addition to all such pieces of furniture as can be fitted with the Brackets, an arrangement allowing unlimited scope for variety both in richness of design and execution.

These Globes can be fixed to any suitable piece of furniture, as well as to mirror-frames, windows, blind-doors, etc. etc., in Offices, Clubs, Libraries, Drawing-Rooms, Aleoves, Bay-Windows, and, indeed, in almost any portion of an apartment where there is spare room for an ornamental and uncumbrous piece of furniture. The Brackets offered by me, whilst elegant and pleasing in design, are both substantial and cheap.



VI G.



V G.

**V G. The Cabinet Terrestrial Globe.** (12 inches.)  
On bronzed hinged Bracket. \$10.00 [\$.80]

**V\*G. The Cabinet Celestial Globe.** (12 inches.)  
On bronzed hinged Bracket. \$10.00 [\$.80]

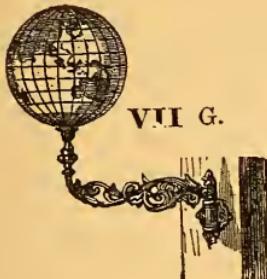
**VI G. The Nine-inch Terrestrial Globe.** On bronzed hinged Bracket. \$6.00 [\$.40]

**VI\*G. The Nine-inch Celestial Globe.** On bronzed hinged Bracket. \$6.00 [\$.40]

**VII G. The Six-inch Globe.** On bronzed hinged Bracket. \$3.50 [\$.20]

**VIII G.** The Four-inch Globe. On bronzed Bracket. \$2.50 [\$0.15]

**IX G.** The Three-inch Globe. On bronzed Bracket. \$1.50

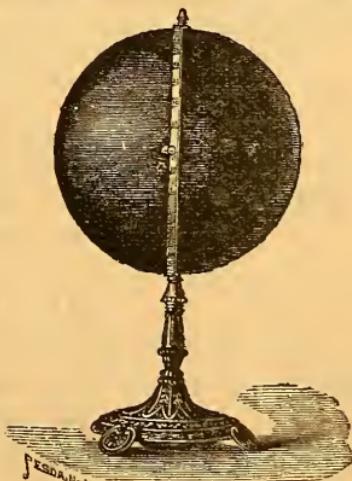


### THE SLATED GLOBES.

These Globes have a slate surface, which readily takes a slate-pencil mark. They are admirably adapted for illustrating those principles and facts in Geography and Astronomy which are most difficult of elucidation to the pupil.

Each slated Globe is furnished with a thin brass band or Guide, which serves, at the same time, as a meridian. This band is divided into sections of 10 degrees each. The pupil places, with his left hand, his pencil in one of the holes given on the line of the degree, and, with the right hand, turns the Globe round to the right. Thereby a line is drawn upon the Globe which forms a parallel of latitude. The pupil then proceeds thus to draw every parallel of latitude.

In the middle of the Guide there is a lateral projection, from the extreme left of which to the extreme right of the Guide is a distance of 10 degrees. The pupil takes hold, with his left hand, of the button in the middle of the Guide, and draws with his pencil, down the meridian, a straight line from the North to the South pole. Thereby a degree of longitude is formed. The pupil then marks a point at the extreme left of the projection on the middle of the meridian, turns the Globe to the right until this point appears on the extreme right of the meridian, again draws a line from the North to the South pole, and thus continues until he has drawn every tenth degree of longitude.



The pupil thus traces a perfect net of degrees, and can then proceed to draw countries, etc. etc., on the Globe, according to a given Map, or if further advanced, from memory.

With the use of these Globes a solid grounding in Geography is acquired. The teacher can at once begin object-lessons, by showing things, and not merely representations of them. Pupils are taught not simply the names of geographical lines, but what these lines are, their purpose, and, what is more important, how to draw according to them. Multitudes of facts and phenomena can be explained and illustrated so simply and clearly, that any child can understand them. The most obscure theorems and problems of Spherical Geometry, Trigonometry, and Navigation become, when studied in connection with the Sphere, perfectly intelligible.

<b>III H.</b>	<b>The Twenty-inch Slated Globe.</b>	On high bronzed pedestal-stand, with casters and brass Guide.	\$40.00	[\$3.00]
<b>IV H.</b>	<b>The Sixteen-inch Slated Globe.</b>	On low bronzed stand, with brass Guide.	\$21.00	[\$1.20]
<b>V H.</b>	<b>The Twelve-inch Slated Globe.</b>	On bronzed stand, with brass Guide.	\$10.00	[\$0.80]
<b>VI H.</b>	<b>The Nine-inch Slated Globe.</b>	On bronzed stand, with brass Guide.	\$7.00	[\$0.50]
<b>VII H.</b>	<b>The Six-inch Slated Globe.</b>	On bronzed stand, with brass Guide.	\$3.50	[\$0.25]
<b>VIII H.</b>	<b>The Four-inch Slated Globe.</b>	With wooden handle.	\$1.75	[\$0.15]

1 Pint Black Liquid Slating (for renewing the surface of the Slated Globe after long use) in tin can, \$1.00. — 1 Flat Brush \$0.75.

### BASKET GLOBES.

This style of Globe is a pleasing ornament for every desk, serves as paper-weight, etc.

<b>VIII I.</b>	<b>The Four-inch Globe.</b>	Loose, on elegant bronzed Basket stand.	\$3.00	[\$0.15]
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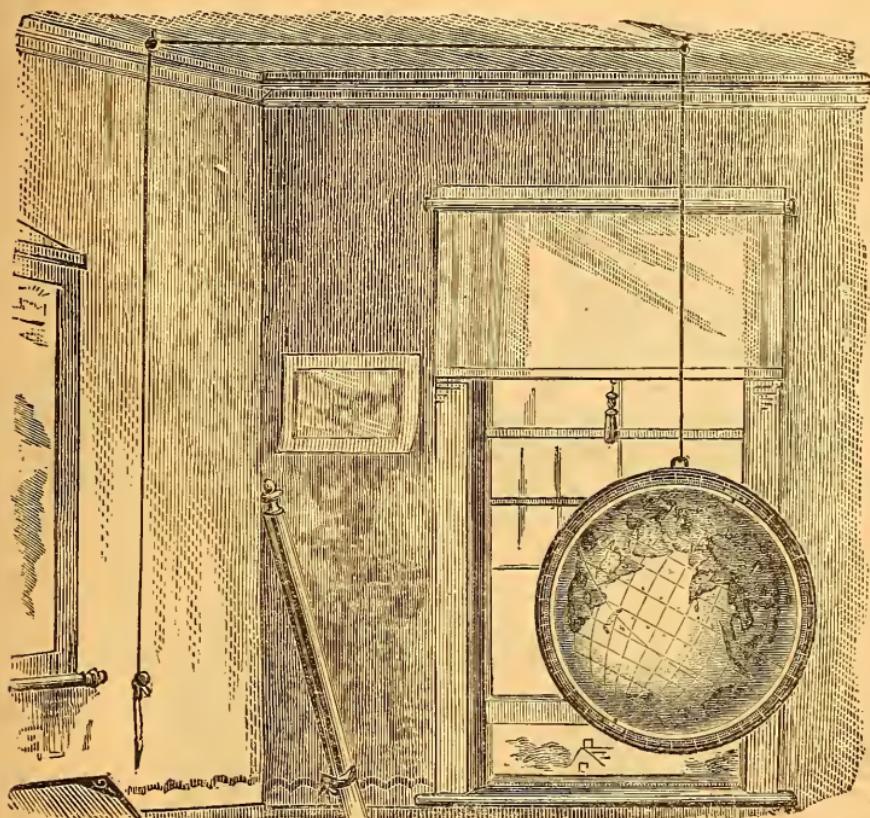


### MASONIC GLOBES

for the fitting-up of Lodges. Plain unmounted Globes.

<b>III K and III* K.</b>	<b>The Twenty-inch Masonic Globes.</b>	Terrestrial and Celestial.	Per Pair	\$60.00	[\$3.00]
<b>V K and V* K.</b>	<b>The Twelve-inch Masonic Globes.</b>	Terrestrial and Celestial.	Per Pair	\$18.00	[\$1.20]
<b>VI K and VI* K.</b>	<b>The Nine-inch Masonic Globes.</b>	Terrestrial and Celestial.	Per Pair	\$10.50	[\$0.80]

## SUSPENDED GLOBES.



This style will be found very serviceable wherever floor or table space cannot conveniently be spared for a Globe. The very low price at which the several sizes are offered, is another point in their favor.

Each Globe is provided with a cast-iron nickel-plated full meridian, 2 bird-cage pulleys, 1 pin, and 6 yards of strong cord.

**III L. The Twenty-inch Terrestrial Suspended Globe.**

\$36.00 [\$1.50] 244

**III\*L. The Twenty-inch Celestial Suspended Globe.**

\$36.00 [\$1.50] 3.12

**V L. The Twelve-inch Terrestrial Suspended Globe.**

\$10.00 [\$0.80] 3.17

**V\*L. The Twelve-inch Celestial Suspended Globe.**

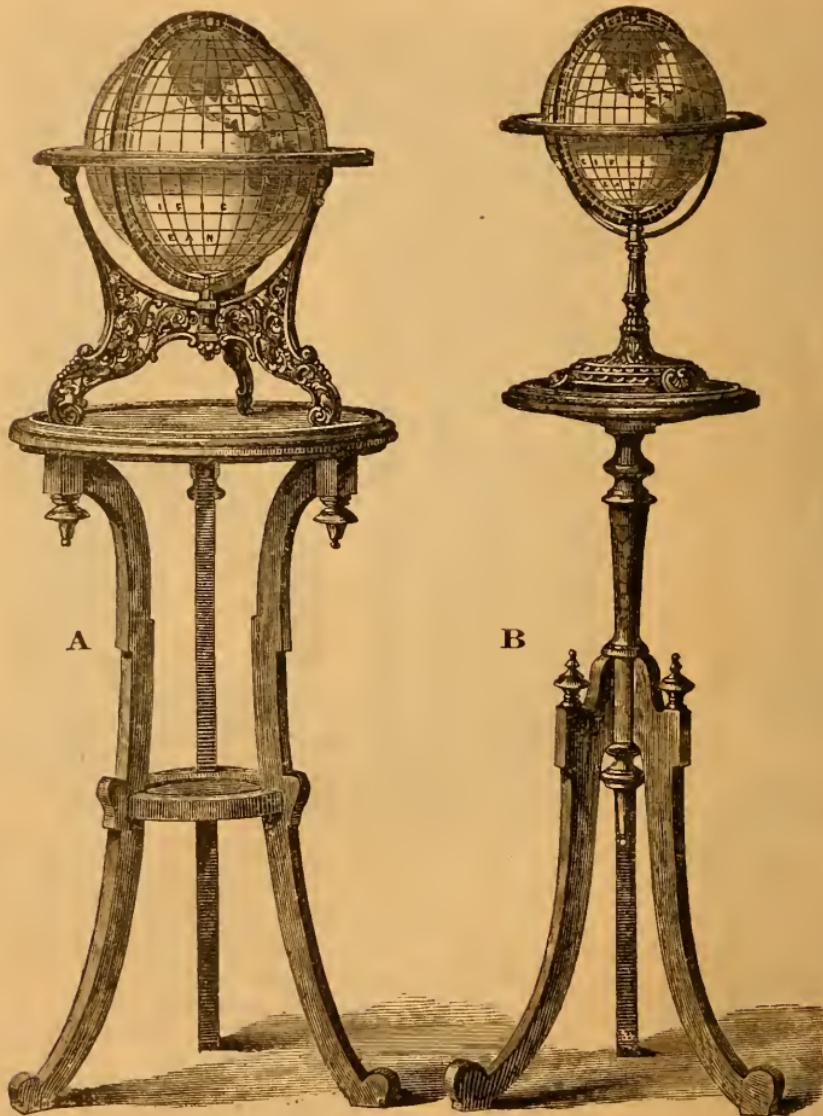
\$10.00 [\$0.80]

**VI L. The Nine-inch Terrestrial Suspended Globe.** \$7.00 [\$0.50]

**VI\*L. The Nine-inch Celestial Suspended Globe.** \$7.00 [\$0.50]

**VII L. The Six-inch Terrestrial Suspended Globe.** \$4.00 [\$0.25]

## BLACK WALNUT GLOBE STANDS.



The above illustrations sufficiently explain themselves.

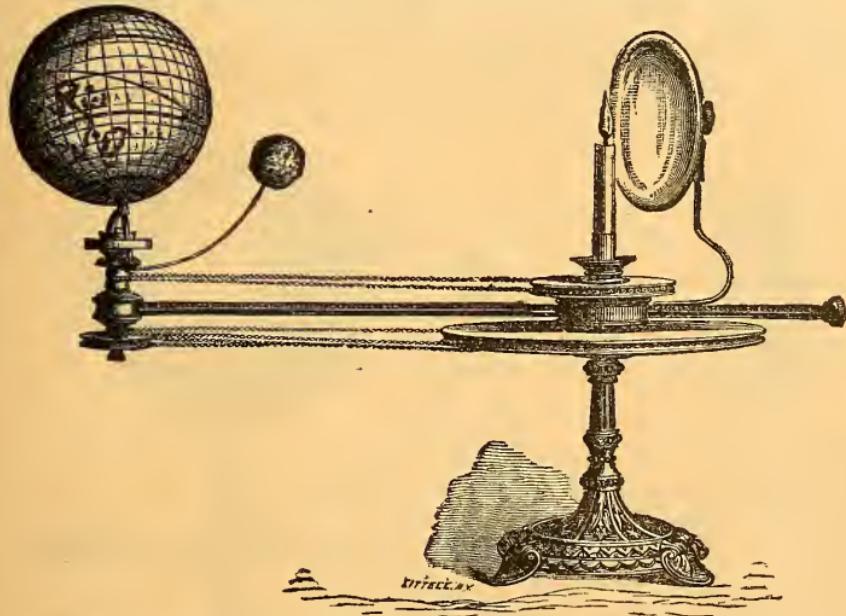
These stands, as here offered, are of black walnut, nicely finished and varnished, simple in design, but solid, and cheap. They afford a field for the display of much taste in design, and can be made by cabinet-makers to match any style and quality of furniture. They occupy but little room, are portable, and, as the Globe is not fastened to them, can, as occasion

may require, be used for a variety of purposes. Thus they are highly acceptable for Offices, Clubs, Libraries, Parlors, Drawing-Rooms, Alcoves, Bay-Windows, and, indeed, in almost any portion of an apartment where there is room to spare for an ornamental and uncumbersome piece of furniture.

**Size A,** for either of the **Cabinet (12-inch) Globes.** (Height of Stand 33½ inches.) \$5.50 [\$0.80]

**Size B,** for either of the **Nine-inch Globes.** (Height of Stand 35 inches.) \$4.50 [\$0.70]

## THE SCHEDLER LUNAR TELLURIAN.



The Tellurian is a valuable aid in the study of Mathematical Geography. The synchronism and regularity of the Earth's revolution on its Axis, as well as of its revolution round the Sun, and of the Moon's revolution round the Earth, may be traced and understood in every phase by this apparatus. Above all, this is the most direct and practical means of making evident to the pupil the eclipses of the Sun and the Moon, the inclination of the Earth's Axis to its Orbit, etc.

The SCHEDLER Tellurian is the most convenient and simple, yet accurate and, withal, **cheapest** instrument of the kind, extant.

The revolutions are all easily produced by the simple moving around — with the hand — of that end of the bar which counterbalances the Globe, quickly or slowly, as may be desired.

The stand is of cast-iron; bronzed, elegant, and sufficiently heavy.

The Globe — a six-inch Terrestrial — is large enough to fully occupy its proper position as an important factor in this truthful representation of the motions of the Earth.

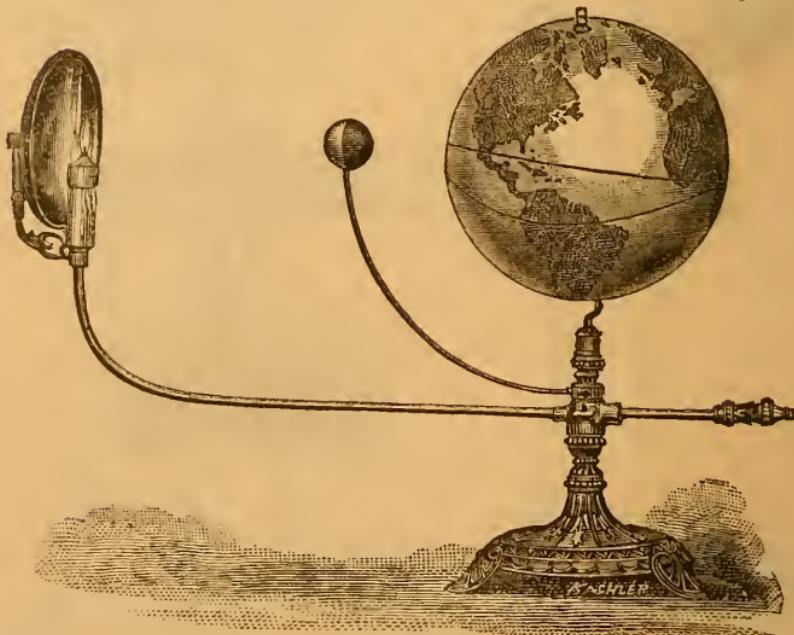
The Moon is covered with a map faithfully representing the wonted appearance of this satellite of the Earth.

**VII M. Lunar Tellurian.** On elegant cast-iron bronzed stand, with 6" Globe of the Earth and 1½" Globe of the Moon. Diameter of the Earth's Orbit 36".      \$20.00    [\$1.00]

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### THE SCHEDLER TELLURIAN-GLOBE.

**VI N. The Tellurian-Globe.** On elegant cast-iron bronzed stand, with 9" Globe of the Earth and 1½" Globe of the Moon. With black walnut bracket.      \$11.00    [\$1.50]

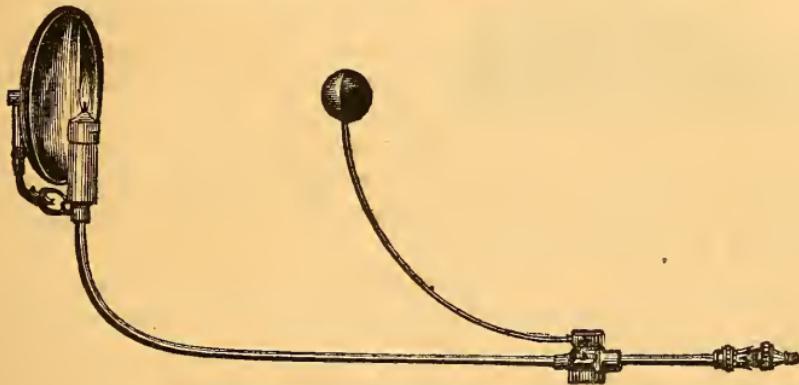


The **Tellurian - Globe** is the most convenient and simple, yet accurate and, withal, the **cheapest**, instrument of the kind manufactured. No complicated machinery, clock-work, or gearing is used; and, consequently, the eye is not distracted nor the attention diverted, by a multiplicity of objects, or by any unnecessary attachments.

The disk, or reflector, representing the Sun, and the sphere of the Moon — constituting, together, the **SCHEDLER Patent Lunar Attachment** —

are quickly and easily fixed to the stand of a nine-inch Terrestrial Globe, which is thus transformed into a perfect working Tellurian. Whenever desired, this connection may readily be detached, so that the Globe may be used for the usual geographical study and reference. The cut on the preceding page shows the complete and simple arrangement of this apparatus, and, in this instance, represents the phase known as the New Moon, *i. e.*, when the Moon's lighted hemisphere is turned away from the Earth.

The hollow reflector which represents the Sun is so constructed that the shadow of the Moon shows clearly and naturally the *Umbra* and *Penumbra* on the Earth's surface, and thus illustrates the difference between a total and partial eclipse. It is also easy to find those sections of the Earth in which a Solar or Lunar Eclipse is visible, to point out the Sun's place in the Ecliptic at any given time, and to explain, in a general way, the cause of morning and evening twilight.



The revolutions are all easily produced by simply moving, in the desired direction, the bar that supports the disk of the Sun or the arm that holds the Moon, with such speed or simultaneous movement as may be required for the purpose of demonstration.

While, of course, the proportion as to size and distance of the different bodies represented, cannot be correctly given by this (or, indeed, by any other) apparatus, the principal motions of these bodies and the phenomena which they present can be clearly and satisfactorily explained by the Tellurian-Globe. The warming and lighting of the Earth, the different phases of the Moon, the regular recurrence of sunrise and sunset, of day and night, the changes of the seasons, and the direct effect of the Sun's rays in illuminating the Earth and the Moon, with many other phenomena, may all be beautifully and clearly demonstrated.



The Nine-inch Terrestrial Globe here used is mounted on a strong cast-iron stand, and covered with a very accurate map of the world, embodying all the latest geographical discoveries and territorial changes, including those in Africa and Turkey.

The sphere of the Moon also gives the correct idea of the usual appearance of this satellite of the Earth.

The candle, which supplies the light for the reflector representing the Sun, is held in a patent self-feeding candlestick, which prevents all dripping or soiling; while, at the same time, the light is always retained in one position.

By means of this apparatus, it is, of course, not possible to show the Earth's annual revolution round the Sun, but all

the necessary purposes of explanation and demonstration, as far as concerns the relations of these bodies, are served by the arrangement here made, as the light of the Sun can be thrown on any portion of the surfaces of the Earth or the Moon.

A neat black walnut bracket is furnished, which, if screwed in a convenient place, affords a stand upon which the Tellurian-Globe may be safely placed when not in use.

The ease of adjustment, the simplicity and readiness of movement, the facility of detaching all combinations, and using, when desired, the Terrestrial Globe for other purposes, the advantage afforded for explanation and demonstration, and, above all, **the low price** of the entire apparatus, render it especially acceptable, both in the school and the family, and place it far in advance of all similar instruments.

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A most valuable help in studying Geography and Astronomy, by means of the Globes, is:

JOS. SCHEDLER. *An Illustrated Manual for the Use of the Terrestrial and Celestial Globes.* Edition of 1878. 44 pp.  
In Paper cover. \$0.25; Cloth, \$0.50

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"I am much pleased with the Schedler Celestial Globe obtained from you. For class instruction and even observatory use I prefer your Globe to all others I have seen."

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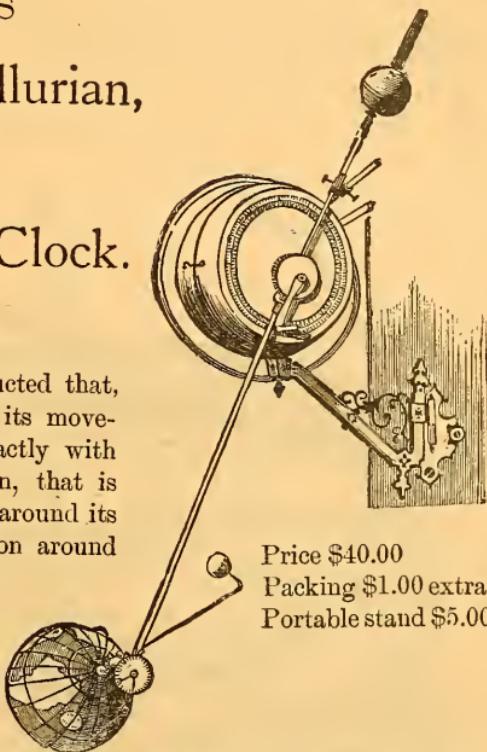
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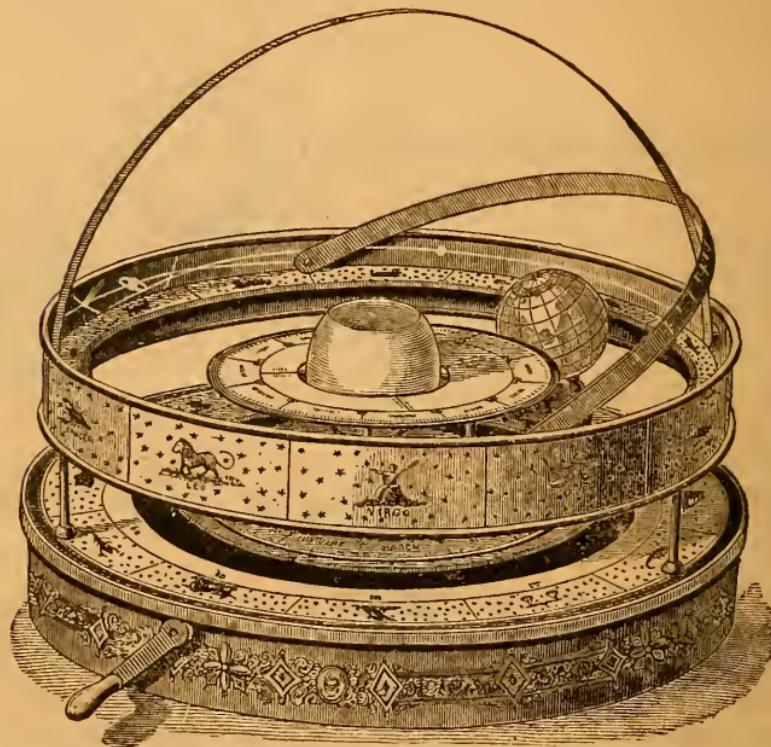


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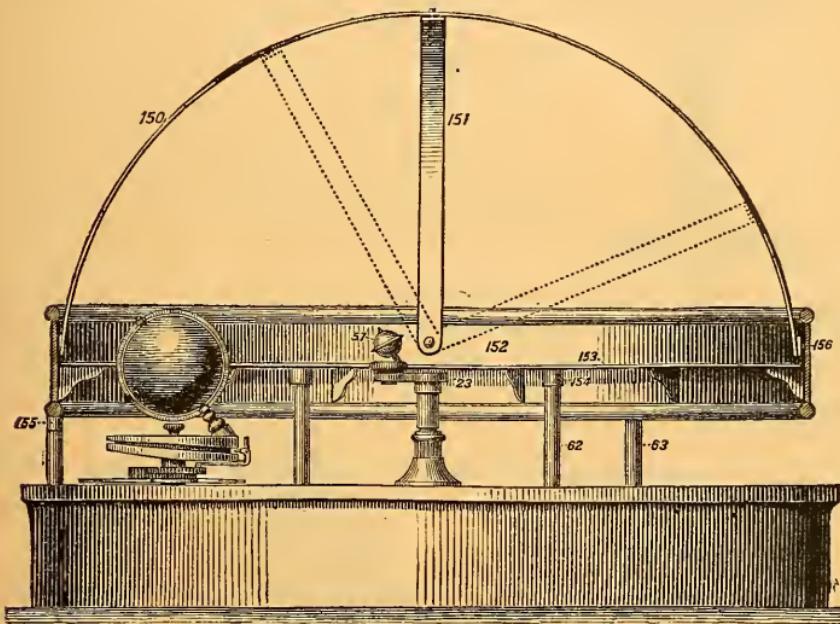
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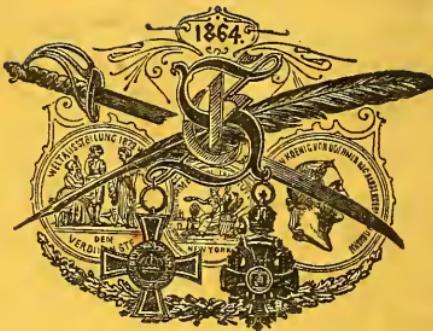
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